INTER-COMMUNITY COMMUNICATIONS IN THE NORTH

Requirements and Alternatives

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In delivering this report, I would like to acknowledge the contributions of various sources to its conception and development. It would not have been possible without the reports of those native and northern groups who have played by our rules and conscientiously written what for years they had been saying, nor without the reports of others, such as Heather Hudson, who took the time to listen. It benefitted also from those who were my colleagues during the process, and who through long discussions helped determine its shape from an amorphous mass of information. Most particularly, it could not have come to be without the special assistance of Al Simpson and Ron Robbins, who tried to help me out of southern naivete, and of Ed DuCharme, who for patient hours explained the difference between the real and the possible.

PREFACE

The Canadian north, which for years lay ignored by its southern neighbours, has within the recent past become a focus of attention for many southerners. Much of the change in posture has come about with the recognition that the north is a valuable source of badly needed energy and biological resources. Where not so long ago the only southern visitors to the north were missionaries, traders, or government administrators, there are now many non-native visitors -- each with his own interest or investment in the north.

One result of this interest has been the generation of a plethora of studies -- on soil conditions, air temperatures, wild life movements, ivory carving, social customs. The information is packaged and taken south, as are other resources, frequently leaving northerners unenlightened as to why it was wanted or what will be done with it.

As the north develops socially and politically, its inhabitants are becoming increasingly and justifiably annoyed at the unidirectionality of the information flow. The reporting back of information to those who have contributed to its collection or who are vitally concerned with its outcome is not only a courtesy, but in this case a necessity for those seeking tools to control and promote the development of the north. This report is an attempt to feed back to the north lessons learned in northern communications.

Why This Report Was Written

During the past few years, the Department of Communications, and other government departments have -- either directly or indirectly -- supported many communications studies in the north. Their activities have included studies of requirements, evaluations of equipment, pilot projects involving the actual installation of communications systems, evaluation of the social impact of new communications systems, etc. In some cases, feedback on the study has been provided to residents of those communities studied, and in

other cases such information has not been made available. It has been recognized, however, that much information exists which could fruitfully be shared with others; the major obstacles to such sharing lay in identifying the information and in presenting it in a readily comprehensible format.

What has been attempted in this report is a pulling together of information on one area of communication: inter-community communications among isolated communities of the Canadian north. It has two main objectives:

(i) to identify and describe the needs for inter-community communications

(ii) to identify and evaluate the various alternatives that could be used to satisfy those needs

The report therefore is intended as a source document for those making, or desiring to make, decisions relating to inter-community communications. It is not a cookbook; it will not declare what ought to be done. Such decisions are best left to those closer to the communities in question. Instead, it represents an attempt to draw together as much as possible of the available information so that those making such decisions will be provided with a more comprehensive basis upon which to do so.

Many sources have been consulted in the process of compiling this information; most of these, however, fall into one of two general categories. The first category consists of briefs and proposals submitted by various native organizations to government. It is on documents of this category that the report relies heavily in its treatment of the needs for inter-community communications. An effort has been made to preserve the intent of the original authors by using their own words as much as possible.

The second category consists of reports of communications studies conducted for the most part by or for government. These documents form the bulk of the material upon which the alternatives section is based. They frequently represent the results of tests of

various communications systems under northern conditions, and therefore aid in the evaluation of the various alternatives. The experience of departmental personnel, and of others involved in northern communications also form an invaluable contribution to the information on alternatives.

How The Report Can Be Used ...

Although the focus of this report is on inter-community communications, one quickly discovers that this is interrelated with many other areas of investigation, and that this area in itself is a broad and complex one. To make the treatment of the subject matter as uncomplicated as possible while maintaining its comprehensive character, the material is segregated into two sections: requirements and alternatives.

The Requirements section enumerates and describes the various uses of communications systems for which needs have been expressed. An attempt has been made to be fairly specific in describing exactly what is included under each type of use, so that one may examine his own situation and determine whether this need is also characteristic of his circumstances. For each of the identified uses, concomitant needs are also specified, for example whether the equipment must be portable, whether a video as well as an audio signal is required, who requires access to the equipment, and how often etc. For each use too, a number of possible alternatives are specified; for an evaluation of each identified option, one is referred to the appropriate part of the alternatives section.

The Alternatives section consists of a series of sub-segments, each of which treats one type of communications system (e.g. HF radio, television, etc.). Within each sub-segment, similar items of information are provided for each equipment type. A description of the equipment is included to provide the user with an understanding of the type of system being discussed: the various parts required, the nature of its functioning, and its most appropriate uses. The equipment is then evaluated in terms of potential, training, and cost.

The potential of a communications system is examined in terms of the clarity of signal, reliability of operation, interconnection with other systems, maintenance requirements, range, etc. The discussion under the heading, "training", looks at the system in terms of the level of skill required for installation, operation, administration, and maintenance of the system, and describes the types of tasks included in each of these processes. In providing information on the costs of communications systems, an attempt has been made to delineate all of the various charges involved in having and operating such a system. This includes installation and training costs, operating costs, and building rentals, as well as capital costs; in some cases specific charges are quoted, while in others (e.g. building rentals) there is simply an indication that such charges must be taken into consideration.

Given this format, one may use the requirements section to help identify the needs for inter-community communications in a specific geographic area. For each need, a number of alternatives have been suggested. One then turns to the sub-segments on each alternative to obtain detailed information which can help in deciding which alternative would be best for those specific circumstances.

However, two caveats must be issued concerning use of this report. The first is that the priorities for regional development in the north must be determined by northern residents. It is recognized that many communities have very serious demands requiring immediate attention before residents consider extension of communications services. For these communities, inter-community communications may be very low on the priority list, and this report will be of little immediate use.

In those areas where communications improvements <u>are</u> given high priority, there may be a temptation to go through the Requirements section and say "yes, we have all of these needs". This may well be true; however, one is urged to turn quickly to the sections on training and on costs in an effort to inject an element of practicality

into the situation. To ensure rational and efficient development of communications that is in keeping with other community/regional goals, it is imperative that representatives of the various interest groups both within and outside the communities meet in an effort to establish priorities for the extension of communication services.

The second caution concerning use of this report is that it should not be inferred that the report is intended as a complete do-it-yourself manual. The area of telecommunication is an extremely complex one, and it would be impossible to adequately treat all the various aspects of inter-community communication in a report -- even if that were the intent. But it is not. The intent is to help establish a level of knowledge of the subject such that there is a familiarity with the terms, an awareness of the options, and of the variables to be considered in decision making.

In most cases, those interested in the development or extension of communications facilities are well advised to seek the assistance of a communications consultant. Money spent initially in this fashion assures that the peculiarities of a specific situation will be taken into consideration, and reduces the probability of experiencing difficulties later on.

REQUIREMENTS

Although to residents of southern Canada "the north" may appear to be a homogeneous mix of people, land and culture, it is in fact characterized by considerable diversity. The diversity stems partly from the isolation of groups from one another in the north, and partly from the vastness of the territory of which we speak. If, for example, one adopts the definition of the north used in the Man in the North report, (Arctic Institute of North America, 1971), a considerable portion of seven of the ten provinces, as well as the territories are included.

In announcing the federal government's policy for funding of native communications, the Secretary of State, J. Hugh Faulkner noted the need for separate policies for the provincial northlands and for the Yukon and Northwest Territories.

> It is my hope that at a later date an announcement will be made with respect to the Yukon and the Northwest Territories. As you are aware the issues surrounding a communications policy in the far north are significantly different than the issues which impinge upon the native people in the south. Therefore, this policy will not at present apply in these two areas. Where, in the south, the central issue is one of native people developing communications programmes which will assert their strength as a minority. In the far north, where the native people are not a minority, the issues are related to cost, distance, technological development, and isolation. (Faulkner, 1974).

The differences to which he made reference are essentially geographic ones. The treelessness and permafrost of the far north pose difficulties for construction which are not important factors in more southerly sections. Also, because of the generally milder climate, it is easier to establish and maintain links between remote communities in the provinces than it is to do so in the far north. The overall result is less of a sense of isolation among more southerly located native groups.

Other differences among northern peoples exist, however, to which no specific references were made, and which do not as readily obey provincial and territorial boundaries. For example,

northern residents break up into three basic ethnic groupings: White, Indian, and Eskimo or Inuit. Each has a different history and culture. It would not be unreasonable to assume that their communications requirements -- and perhaps especially their way of stating those requirements -- would vary as a result of these differences.

The diversity of cultures, languages, social structures and habitats of the people of the north makes it difficult to provide one set of specifications for their communications requirements. During the past few years, a number of native groups have submitted proposals or briefs to various departments and agencies of government outlining their requirements. These briefs have varied considerably in the specificity with which they describe their needs - perhaps because of differences in needs, perhaps because of differences in ability to express needs or in familiarity with the subject. Nevertheless, these submissions form the main source of information for this section on communications requirements.

A review of the submissions reveals nine general types of use to which inter-community communications systems are or could be put:

- emergencies
- education
- cultural exchange, preservation
- announcements of meetings, gatherings, etc.
- band, council business
- information from government agencies
- weather reports
- plane, ship movements
- news of events, friends, relatives; chatter

The order in which these requirements are presented is not intended to denote importance. There will probably be little disagreement on the assigning of highest priority to the need for communications systems for emergency purposes. However, the priorities assigned to the other needs would vary with different communities and different groups within communities.

Nor should it be inferred that the categories are mutually exclusive, or that they represent an exhaustive list of native groups' communications requirements. A specific need may at times fit into two or more of the categories; also there may be other types of needs of which we are not now aware.

Emergencies

Almost all groups are unanimous in demanding that a community have the potential to contact another community in emergency situations. Although there are many circumstances under which other situations can become emergencies, two types of situations are perhaps most frequently cited as causes for alarm - the medical emergency and the case in which a person or persons become lost under difficult weather and terrain conditions.

Medical emergencies in the north are especially serious because of the lack of medical personnel and facilities in many of the small communities, and because of the difficulty of transporting the sick or injured person to a medical centre. Dr. Elizabeth Cass, of Fort Smith, N.W.T., described such circumstances in her statement at the Yellowknife Conference:

> Improvements in communications to isolated places are essential to support health services. Communications are presently very inadequate. The only means of communication along the Arctic Coast from Cambridge Bay to Pelley Bay is by radio telephone. If that fails there is no other means of communication. There is no nurse at Pelley Bay which has a population of about 240 people. No help is forthcoming if there is an emergency. Even for a doctor this is a frightening situation. (Cass, 1970).

One of the recommendations of the Yellowknife Conference was that reliable two-way telecommunications services be made available to all permanent communities having populations greater than 25 or 50. They recommend that it be operational or at least available on a seven-day 24-hour basis, and that it be of a quality such that it would not be subject to malfunctioning due to climate or other natural variations. (Yellowknife Conference Record, 1970).

Not all communities in the north are permanent ones. In the past, many natives led a nomadic life, usually travelling so as to take advantage of favourable game and hunting conditions. The influence of white government administrators led to a considerable curtailment of the nomadic character of native life, and encouraged more permanent settlements. However, it did not eliminate it entirely, and in fact, there seems to be a recent increase in the trend.

In many parts of the north, native groups residing in a permanent community still seek a living, or seek to supplement their income by living off the land. This involves travelling about in small (usually family) groups in search of fish or animals for food or hides. Such groups are frequently away from the main community for days or weeks at a time, and usually with no means of contacting the community. Severe storms can leave them isolated and unable to return home; accidents or other medical emergencies under such situations are particularly dreaded. The Yellowknife Conference recognized this problem and recommended that:

> Nomadic or hunting groups should be provided with low cost radio units to contact their resident community in emergency and other urgent situations. (Yellowknife Conference Record, 1970).

Proposals to government by the Yukon Native Brotherhood (Smith, 1972), by the Indian Brotherhood of the Northwest Territories (1972), and by the Radio and Visual Education Network (RAVEN) of British Columbia (Recalma, 1973), have also emphasized the importance of assuring that isolated communities have a reliable means of communication for emergency purposes.

To evaluate a communications system for its suitability as a means of satisfying emergency uses, one should look for the following characteristics:

(i) available for operation at all times of the day, week, year
(ii) dependable operation: not seriously affected by climatic or other interferences
(iii) easy to use, operation readily understood by those with little/no training

(iv) two-way communication possible
(v) range sufficiently extensive to permit contact with desired community(ies)

To satisfy emergency needs of nomadic or hunting groups, the following criteria must also be added:

(vi) portable: lightweight, self contained
(vii) capable of operation in extremely cold temperatures
(viii) rugged: operational after movement via various vehicles; waterproof
(ix) capable of operation with various power supplies (Robbins, 1974).

The first set of requirements would be satisfied to varying extents by high frequency (HF) radio, by telephone, and teletype; the second set of requirements call for some form of trail communications.

Education

The requirement for a means of communication to satisfy education needs is one strongly felt by native peoples. This is seen as an area in which control over their future has been relinquished to non-native administrators, and native northerners are now demanding that control back. In earlier times children were educated within the family or tribe -- in those areas and skills parents felt it important to learn and in the way in which they felt they ought to be learned. When non-natives (at first the federal government and church groups) assumed responsibility for the education of children, much of the control parents had exercised over their children was removed.

> ... we had no way of knowing how they were being educated and developed for 10 months of the year. The residential and hostel system was a way of solving the problems of distance and the scarcity for teachers, bringing the native children to a central place where this institution was their home 10 months of the year, or for some, over two months of holiday in the summer as well. Consequently, the parents had very little say in how their children were growing up. (Committee for Original Peoples Entitlement, 1973).

Some improvement has come with the establishment of schools in some northern communities; however, native groups would see still further changes before the educational system meets their demands.

One demand which is sensed most strongly by native groups in the far north is that more schools should be located in the small communities so that children would not have to leave their homes to attend school. It is among the Inuit that it is most frequently necessary to go away to school. However, in recognition of the fact that it may take a considerable length of time before this demand is met, there is also a requirement for a better means of communication between home and the distant school so that parents may keep in touch while children are away. This implies a readily accessible, inexpensive means of communication which may be used frequently so that the link between community and school life is not broken.

Still recognizing that the existing system is unlikely to change in the near future, parents make two more demands: that their children have an opportunity to learn English before going to school, and that their children be given information on customs and conditions in distantly located schools before attending. It has been found that children must frequently attend a school where the language of instruction is English; when the language spoken at home is Inuktitut or Dogrib or Cree, the child frequently spends the whole of his first year learning to speak English.

In other cases, older children are often sent to high schools in southern centres, where they are unfamiliar with many of the habits and customs. It is felt that an information program designed to help them learn how people in southern centres live and what is expected of them will relieve the sense of inadequacy and lack of self-confidence experienced by many.

Other demands in the area of education relate more to the assumption of control by native groups over the educational

process and content. There are demands for more native teachers, and for an increase in the proportion of teaching done in native languages. There are demands that parents in the local communities have more to say in determining the content of courses, and a general demand that there be less of a southern white, and more of a native orientation in both content and the manner in which the material is presented.

There is also a requirement for a means of providing adult education. Adults who find themselves in an increasingly modernized world have a need for some source of information which would help them to understand and adapt to that world. For example, the conduct of small businesses, health and hygiene measures, and the structure and operation of the federal legal system were among the areas mentioned at the Yellowknife Conference as appropriate subjects for adult education programs (Yellowknife Conference Record, 1970). Any activity undertaken in the area of adult education would have to be so designed as to recognize the needs of adults; that is, the programs must not only be on subjects of interest to and requested by native people, but they must also fit into their way of life. This might require that the programs be available at their place of work or their home; or that they be in a form such that those having need of them might have access to them whenever convenient.

It may seem that this whole issue of education has strayed somewhat from the original subject of inter-community communications. However, this is not really the case. The link between the two derives partly from the recognition of the fact that many of the demands within the field of education cannot at present be met, and may not be met for some time in the future. However, changes within the communication system might well produce the desired results. For example, where there is a shortage of native teachers, the broadcasting of programs (or courses) in native languages to remote villages from a central northern location might well form a constructive start to satisfying some demands.

The requirement for some native content in course work might also be satisfied by the production of programs, lectures, etc. about native history, culture, and language. Such programs or lectures could be produced by native groups in the north, and then broadcast to, or sent to remote villages.

The expressed concern that children not be sent away to school, and that adult education programs be available when needed, also indicates an appropriate application for communication facilities. Again, the broadcasting or sending of educational material from a central location to remote villages would reduce or eliminate the need for travel, and could also be so designed as to incorporate an interactive feature and/or to be adaptable to various personal schedules.

Most of the demands in the area of education can be summarized into two categories: those relating to contact, and those relating to content. The needs for contact centre mainly on the establishing of better communication between students at distant schools and their parents. Under content we are including those needs relating to changes in educational material and format of presentation.

- contact
  - better communication between parents and students
- content
  - learn English before school
  - more information on remote schools
  - more native teachers
  - more teaching in native languages
  - more native input in content
  - programs for adult education

While the two categories both relate to education, they differ considerably in the requirements they make of a communication system. In developing a communication system for the prime purpose of contact between parents and children away at school, one should ensure that it satisfies the following criteria:

- it should be reliable, so that contact may be established frequently, and when desired;

- its range should be such that it permits contact with school locations;
- it should be a two-way system, of sufficiently high quality that it permits and encourages conversation similar to that in a face-to-face situation;
- it should be very inexpensive so that the desire for contact will not be dampened by the prospect of the charges to be incurred;
- it should permit privacy, so that some aspect of family intimacy can be preserved;
- it should be easy to use so that both parents and students can take advantage of it without the need for training, and without the need for an intermediary.

These criteria may be satisfied to a greater or less extent by H.F. radio or telephone. Since each has advantages and disadvantages, it is advisable to determine the relative importance of each of the above criteria, and to then refer to the appropriate sub-section on Alternatives to obtain more information on the specific characteristics of each type of system.

When a proposed communication system is intended to satisfy requirements in the area of educational content, a different set of criteria should be applied. The following is a specification of the more important factors to be considered in planning a communication system for such purposes:

- one-way/two-way communication: One should consider whether it is necessary that the system have a potential for interaction. In many cases, a one-way facility will be quite adequate; it could allow, for example, for the broadest of radio or television programs in specific content areas. In some cases it may be felt that there is a need for feedback -- perhaps to allow for language practice, or to request additional information, or to test comprehension. These requirements would imply a need for two-way communication, and it might be advisable to explore possible combinations of systems. For example, one could have an educational program broadcast over television or radio, and questions or

responses fed back to a central location by means of telephone, teletype or mail.

- production: The demands for more native content and teachers require that the capability for producing educational programs be in the hands of native peoples. Depending upon the medium selected, the training and the facilities required for such capability can be costly and complex. While the benefits accruing from a well planned production centre can go far to satisfy many of the educational requirements of native peoples, one should also be aware that it generally requires that a considerable effort and sustained enthusiasm be invested over a number of years before the centre is satisfactorily functioning.

- distribution: By distribution we are referring to the means by which the produced program is sent to its intended audience. There are many possible ways in which this might be done; for example, broadcast over the radio frequency spectrum, cable links between the production centre and the community, or the mailing of taped programs. More information on distribution possibilities is given in the section on Alternatives, but one ought to keep the following questions in mind in selecting the appropriate system:

(i) who are the intended audience, and where are they located?
(ii) what kind of receiving equipment is required?
(iii) can the program distribution be delayed, or must it be immediate?

The identification of the intended audience (i) helps determine the geographic area over which the program must be distributed. In a subject like education, and in an area like the north, it may well be desirable to reach as many people as possible, and the geographic area included may be extensive. This would necessitate the transmission of a very powerful signal (if the program were broadcast), which could be very costly.

It is important also to look closely at the type of receiving equipment (ii) required by various systems. In the case of an AM or AM/FM radio, this may not be a problem as many people are already

in possession of such radio sets, and in any case, they are relatively inexpensive to purchase. If a television set is required, these are more expensive, and ownership may not be so widespread. If the system involves the showing of films, there is a requirement for a screen and a projector, as well as a central location in which to show the films. If the selected system involves the sending (e.g. by mail) of tapes of programs to communities, it will be necessary to ensure that there is equipment suitable for playing back the tape in the community. In the case of audio tapes, a tape recorder is required; in the case of video tapes, there is a need for a small television monitor with play-back capability -- the latter is considerably more expensive than the former. Finally, one should consider whether it is necessary to have one receiver per community, one per school classroom, or one per family, etc.

The question of whether program distribution is to be delayed or immediate (iii) partly determines the means of distribution which can be used. When distribution must be immediate, then some form of broadcasting, or the use of cable plus broadcasting must be employed. This permits either the distribution of a program as it is being produced, or the recording of a program for later distribution. When distribution can be delayed, one should seriously consider the use of the mail for distribution. This suggestion may cause some shuddering, given knowledge of existing mail schedules, (especially to small, remote communities) and also given the unreliability of the system because of weather and other unforeseen factors. However, this method is much cheaper than any other, and it should be possible to send enough programs to a community to cover the interval between mail deliveries. A final point which should be made is that the taping of programs, and the sending of tapes to communities permits community residents to schedule the presentation of those tapes so as to suit their own needs - instead of having to be by a receiving unit when the program is broadcast from the centre.

The area of education is an important one, and one in which it is necessary to exercise a great deal of care in selecting an appropriate communications system. Among the systems most likely to satisfy community requirements are radio, television, film and teletype.

Cultural Exchange, Preservation

Another area of need rather closely related to the field of education is the requirement for a means of communication that would permit cultural exchange and preservation. The submission on behalf of the National Indian Brotherhood describes the sense of isolation that has served to motivate cultural exchanges between communities:

> The Indian generally became isolated in Indian reservations and this effectively cut them off from communications and interchange with the neighboring non-Indian communities. Also reservations tended to be isolated from each other physically and this resulted (for many years) in very effective barriers to communication between Indians. The main channel through which the Indian had any communications was with the Indian agent who was the representative of the Government of Canada. This communications system tended to be a one-way street, from the top down with little opportunity for the Indian to communicate his problems, needs or wishes to those in authority, or to share his experiences with Canadian society generally. (Federation of Saskatchewan Indians, 1973).

The considerable strengthening in native organizations that has come about within the past few years has been accompanied by a determination to never again allow such a sense of isolation to envelop native peoples.

Better communications between communities in the north, and between north and south, are seen as important in preventing this. This communications requirement can be broken down into three types of needs:

(i) to preserve the traditional cultures;

(ii) To share information with other native groups so that they may recognize common problems and seek common solutions;

(iii) to share information with non-native groups so that whites may better understand their needs and goals, and so that they may understand whites better.

The first requires that there be some means of recording aspects of traditional cultures before they are lost. This includes folktales, traditional songs and dances, and instructions in the traditional crafts such as weaving, hunting, carving, the preparation of hides, etc. For this application, the following considerations are relevant:

- the use of audio or video recorders will most frequently be found appropriate. For certain aspects - e.g. the preservation of folktales and songs - it may be sufficient to use an audio tape recorder. However, other aspects, such as traditional dances, and instructions in certain of the traditional crafts will require at least a video recording, and probably an audiovisual recording. It is important to consider the nature of the aspects to be preserved first, so that the system selected will satisfy the need.

- the receiving units to be used with the system should also be considered. It will be important to ensure that they are compatible with the equipment used for recording, and that they are readily available to those people who are the intended recipients.

- the recording equipment should be portable. The selected system should allow for aspects of traditional culture to be recorded in their natural settings. This requirement is fairly obvious in the case of events to be recorded by visual or audiovisual means; however it is also important for audio recording, because it facilitates access to people who might be too old, or not well enough to travel to a central recording location. Special care must be exercised in the selection of portable equipment so as to ensure that the quality of the recording produced is comparable to that obtainable from stationary equipment.

The second type of need (sharing information with other native groups) involves the assurance of reliable, two-way communication

between communities, and the sense that these facilities are available for use in discussing common elements of heritage and culture, common problems and solutions. It is important then, that systems selected for this application be of a quality such that conversation and discussion are encouraged, rather than simply the sending of messages.

Beyond the discussion of common interests, there may be specific aspects of culture which one community may want to share with another, e.g. folktales, or stitching patterns. In this case, the requirement is for the potential to record and play back aspects of culture as discussed above. The exchange of such tapes between communities could be by means of mail, or by broadcast; the criteria noted above, and in the previous section on educational content are relevant to this application.

Another point which applies to both the preservation and exchange of traditional cultures relates to the cataloging and accessing of recordings. If it is intended that a library or large number of recordings be produced and made available to interested members of other native groups, there will be a need for some sort of index which tells what is available and how it can be obtained. This may be a manual operation or if a very large number of items are involved, there may be a requirement for a computerized operation. Computerization is a very expensive undertaking, but when properly set up, it can handle tasks such as keeping a record and description of all recordings, selecting and showing (e.g. on a T.V. monitor) recordings as requested, and linking many small, remote communities with a central storage location so that the service is available to many without the need for travelling or mailing.

The third type of need mentioned above was for exchanges between natives and non-natives. This can be viewed as having two components: it requires not only reliable two-way communication for informal discussion and consultation, but also the potential to put together an information program which will accurately describe ways of life, values, goals, needs and problems.

In the first application the emphasis is on increasing the amount of talking between non-natives and natives, and this usually implies a need for north-south communications. Much of what the north and south know of one another is shaped by half-facts and hindered by distance; this is slowly changing as more travel takes place between the two, but there is still a need to encourage revelation of reality through more communication between the two areas.

The second application for an information program is for the most part a need for formal, one-way communication. It is an attempt to avoid partial truths and misinformation by developing a message for the sole purpose of telling another group about your way of life, needs or aspirations. It may take any of a number of forms, for example:

- a proposal to government specifying a need for a type of service or a change in existing arrangements;
- an audio or video recording of some aspect of traditional culture as described above;
- a documentary film intended to show how aspects of technology are affecting traditional cultures.

In developing an information program, it might be useful to be aware of the following points:

- It is important to decide beforehand the exact message which should be transmitted. This does not refer to wording, but rather to the nature of the message. When presenting information on behalf of a group, it is important to ensure that what is said is reflective of the feelings of a good part of that group, and not just those responsible for preparing the message.
- Any of a number of possible means of communication may be selected. Often more than one medium is used; each presents one aspect of the message, and care is taken to ascertain that the point of view of one supports the other.

- The production of the message may require a little, or a lot of training, depending on the medium selected; a taped message intended for broadcast over radio may be prepared with relatively little training, for example, while the preparation of a film or television program requires considerably more expertise.
- The recording of a message or program allows it to be presented more than once, and allows for multiple copies of the recording to be distributed among many groups. This means wider distribution at relatively little increase in cost.

Because of the multiplicity of possible approaches to a cultural exchange between native and non-native groups, there are many alternative types of communications systems which could be used. Some of the more appropriate ones have already been mentioned above in relation to specific applications. For more detailed information, one is referred to the sub-sections on radio, television, film, HF radio, telephone and teletype alternatives.

Announcements of Meetings, Gatherings, etc.

One difficulty that has been experienced by many native groups is that of organizing for political, social, or other purposes, the many small bands and family groupings who live in widely separated communities. In traditional times, the area of influence of a band tended to be limited to a local level, and where regional bodies did exist, meetings were convened on a relatively infrequent basis. At present, however, native peoples are experiencing a need to form more active and powerful regional organizations. The intent is to develop organizations that will be capable of exerting a more persuasive influence in helping native peoples satisfy common needs, e.g. in the areas of land claim settlements, education, housing, or employment.

To do this requires that there be some reliable and permanent means of establishing contact among the various smaller bodies that make up the regional organization. It is important that

the organization's administrators have the capability of informing people of meetings in which they might be interested, or at which their attendance is important.

To a certain extent, native groups have been active in attempting to assure that they have the means to meet and consult on issues affecting them as a larger regional group. Chief Elijah Smith of the Yukon Native Brotherhood describes this organization and the factoes motivating it:

> ... the numerous injustices which were suffered by the Indian people, were continuing to grow. In the 1960's the Indian people on a national basis, realized the immediate need to organize, and out of this realization Indian organizations were beginning to appear. In order to present all national Indian issues in a united manner, an elaborate communication system was established. Telephones, telexs, radio-telephones, letter writing and newsletters were the basic components of this communication system. The central organization in the Yukon had these modern devices, however, due to the lack of northern development most, if not all Indian communities did not have these time-saving devices. (Smith, 1972).

What is needed, then is a communications network that would allow the members of native organizations to announce both formal and informal meetings of the body to those interested, and to those who should attend. In selecting the facilities for such a communications network, the following issues should be considered:

- frequency of need: If there is only occasional demand for the facilities to make such announcements, serious consideration ought to be given to whether additional funds and effort ought to be spent on expanding existing facilities -- whatever they may be. It may well be that existing arrangements are adequate to handle announcement requirements on an infrequent basis. If, however, the need for such capability frequently arises, or if there is substantial reason to expect an increase in the demand for such facilities, development or expansion of the potential is probably warranted.
- amount of information: Consideration should also be given to the kind and amount of information that is to be communicated in the

announcement. If the content is simple - e.g., date, time and place of meeting -- a less expensive system may suffice. However, if for example there is a requirement to communicate a considerable amount of background information, a detailed agenda, or lists of numbers, one should look for a system that will transmit a lot of information at a cheap rate, that will transmit accurately, and perhaps also one that will produce a written copy of the information transmitted.

- need for response: In some cases, there is a need simply for some facility which will permit an announcement to be made; it is assumed that those concerned will receive the information, and no response is really necessary. For these applications, a one-way facility, such as a local radio or television broadcast, would be appropriate. In other cases, some sort of response is necessary. It may simply be an acknowledgement of receipt of the message, or information on who will attend the function, or it may be a more complex response -- for example, demanding more information on the agenda, or suggesting a topic which should also be considered. Here, it is necessary to ascertain that the selected facility permits two-way communication, and is appropriate for the type and amount of information which is to be exchanged.

- immediacy: Another factor to be weighed is the speed with which the announcement must be made. Some announcements can be scheduled well in advance, while others occur on a more urgent and unanticipated basis. When there is sufficient lead time, one can usually contend with transmission difficulties, different transmission and reception schedules, and unmanned facilities, and still expect to have the announcement made in sufficient time. When the message is an urgent one, requiring immediate action, these sources of possible delay can cause serious problems; decisions must be made as to whether this is a reasonable risk, or whether facilities must be selected so as to eliminate such problems.

- range: One must also give some thought to identifying the communities to which announcements are to be made. There must be assurance that

each community is equipped with facilities that permit reception of the message. Moreover, the distance between communities and the direction of one in relation to another, should be borne in mind. The equipment selected should have a transmission potential sufficiently powerful to permit contact with the selected communities. Where the distance is especially great, one may want to consider the possibility of establishing more than one communication system, with a contact point between systems which would allow for the transfer of messages between communities in one system and those in another system.

- mobile groups: It happens, and not infrequently, that some members of northern communities leave their permanent settlements for periods of time to go out onto the land to hunt or to trap. It is not unusual that these hunting or trapping groups should include community leaders and/or representatives of regional organizations. It is necessary to determine whether there is likely to be a need to contact such mobile groups to make announcements, and whether this need is sufficiently strong to warrant obtaining mobile as well as stationary facilities.

The relevance of each of these issues will vary from one community to another; it is the responsibility of community members to weigh each, and to decide whether it applies to their situation. The most appropriate communications system for their announcement purposes should reflect their particular situation and requirements. Depending on what these requirements are, there are a number of alternatives which might be appropriate; for more information, one should refer to the Alternatives section under the sub-sections on H.F. radio, trail communications, telephone, teletype, radio, and television.

Band, Council Business

Closely related to the potential to make announcements about meetings is the requirement for a means by which to discuss band, and council business remotely. Both are motivated by the desire

for strong regional organizations. In the area of band and council business, two applications can be specified:

- the actual conduct of business among groups widely separated from one another;
- the dissemination of information on band and council business to members of the general community.

In its presentation to the Department of the Secretary of State, the Wa-wa-tâ Native Communications Society emphasized the need for the first type of application.

> Communications systems in remote northern Ontario have varied in form over the last fifty years but their lack of reliability has been constant. The ramifications have been serious ... issues revolving around government policy relevant to the area have lapsed, or been considered after the fact because there was no vehicle for discussion among the leaders and great distances between the communities prevented the chiefs from getting together quickly; band administration has been slowed down and the drive for the autonomy of local government retarded. This situation was of great concern to the Chiefs. (1974).

The circumstances in northwestern Ontario have been considerably alleviated through the efforts of the Department of Communications' Northern Pilot Project. However, there is a continuing requirement that small, remote settlements have the potential of communicating with the members of their official native political structure so that structure may be made more representative of those whose views it is supposed to reflect.

In an effort to knit more closely together small bands and tribes with the organizing activities or regional or provincial native bodies, the British Columbia RAVEN Society has made videotapes of the proceedings of the B.C. Chief's Conferences. The videotapes are then made available to the bands for viewing so that they may have (almost) first hand information on the activities of the conferences. The dissemination of information such as this increases awareness among general community members of the issues discussed and viewpoints expressed by their representatives, and also serves as a cohesive force in that it increases the base of common information available to members of different communities.

If and when it is established that there is a need for a means of communication of band and council business, a number of factors will be instrumental in determining which system would be the most appropriate. Some of the factors which should be considered are discussed below:

- privacy: It is to be expected that some of the business conducted by bands and councils would be of a confidential nature, and that there would be a desire to restrict access to the information. Certain types of communications systems (e.g. H.F. radio) do not permit privacy; where the privacy of communications is important, and where there is a frequent need for such service, care should be taken to ensure that the selected system satisfies this demand. If the requirement for privacy is an infrequent one, it may well be that less private systems will suffice for most purposes, with resort to other means (e.g. letter, messenger) on those occasions when privacy is essential.

- range: A related issue is that of which, and how many communities are to be contacted. It must be determined whether the need is to reach only specific individuals within a community, or whether the need is to broadcast a message to whomever happens to be listening; each type of application calls for a different type of communication system. As well, it is necessary to ensure that the selected system is sufficiently powerful to reach the intended recipients.

- two-way communication: In most cases, the use of a communications facility for band and council business will require the potential for two-way communication. The need is obvious in those circumstances in which the community leaders or representatives must discuss and resolve issues from distant locations; but it also is important as a vehicle by which members of the community-at-large can input to their leaders information on their views and needs.

- video/audio: Another consideration to be examined is whether the specific needs indicate a requirement for an audio, a video, or an audio-visual mode of communication. It seems highly probable that

many requirements can be satisfied by a system having an audio facility only. In other cases, however, it may be imperative that a record of the proceedings (e.g. on paper, or an audio or video tape) be kept, or that a facsimile of a document be transmitted to all those contacted. Since the potential for such service usually adds considerably to cost of communications systems, it is important to assure that the needs are sufficiently strong to warrant incurring the extra expense.

- immediacy: The implications of this factor are similar to those noted under the section on announcements. When there is sufficient lead time, one may be able to contend with the delays inherent in certain types of systems. When the need is more urgent, the selection of a highly reliable system is imperative. The benefits of one must be weighed against the costs of the other in relation to the anticipated needs.

- mobile groups: Also, where it is likely that there will be a need to contact mobile community members on issues of band or council business, provision should be made to equip those members with communications units that will permit an adequate means of contact when they are away from their base community.

Finally, a more general note is in order on the issue of communicating band or council business to and from distant locations. This is a reminder (and one that holds true for other communication needs) that in selecting communications systems, one should be cognizant of the fact that certain needs can be expected to change in the future. When an organization is at a certain stage of development that is likely to be changed in the near future, it should be alert to the fact that changes in its communications requirements are likely to ensue as a result of development.

In the case of band and council business, it would not be unreasonable to expect that the need for privacy for example, would grow as the organization became more sophisticated. When planning the acquisition of a system, it is important to try to

anticipate future needs so that the selected facilities will be able to satisfy needs in at least the short term future as well as at present.

The possible alternatives from which one might select include the following: HF radio, trail communications, teletype, telephone, radio, television, and film. Each of these can be expected to satisfy some, but not all of the above noted criteria; more information can be obtained under the appropriate sub-sections of the Alternatives section.

Information from Government Agencies

Because the government's presence is heavily felt in the north, there is a requirement for some means of obtaining information from government agencies. This includes a day-to-day need for information, such as queries on the reason for delays in welfare cheques, requests for police assistance, or requests for information about children away at school. It includes also those situations in which there is a continuing mutual need for close cooperation between the community and (for example) the game and forestry departments of government. Such items can be directed to any of the various levels, departments and agencies of government.

There is also another type of requirement for information from government. This more general need springs from a demand for more control in future decisions relating to native groups by native people themselves. It is generally recognized that there must be more consultation between native groups and government so that joint decisions can be made on issues affecting native peoples. This message was given voice in the Man in the North study (Arctic Institute of North America, 1971), and has been stated as one of the basic objectives of the National Indian Brotherhood's Indian communications program (Federation of Saskatchewan Indians, 1973). The requirement is not only for facilities for communication, but also for a willingness on the part of both government and native groups to share in the process of decision making.

- two-way communication: If there is to be a sharing, then it becomes imperative that communication systems intended for such use have a potential for two-way communication. Moreover, it should be of a quality that encourages discussion, rather than simply the sending of messages in each direction.

- type/amount of information: Many of the requests for information from government are ones that require only a simple, factual response. However on the level of a more general sharing of information, there will be a need for more complex communication, with larger volumes of information, and shared on an ongoing basis. The selected system should be one that will allow the latter type of exchange as well as the former.

- range: Because of the existing governmental structure, many of the requests will imply north-south communication, while others will involve contact with government representatives at administrative centres in the north. Care should be taken to identify those points with which contact is expected to be most frequent and most desirable, and to ensure that the selected system has the potential of communication with those points.

- reliability: The present dependence of many native peoples on government for essential services, and the increasing pressures for greater consultation between the two groups makes it important that the selected communication system be sufficiently reliable that one may expect to be able to establish contact whenever necessary.

- record of contact: Since many of the interchanges that take place between government and native groups are of an official nature, consideration should be given to whether there is a requirement for a record of the contact. A "hard" or paper copy of a transmitted message may be required at a future date as evidence of a statement made or a standpoint taken on a specific issue, or as proof of the date and content of a submitted request etc. Since the capability for recording contacts usually means additional expenditures, the benefits of the facility will have to be weighed against the extra cost.

The options that might satisfy a community's requirement for a means of obtaining information from government agencies include H.F. radio, telephone, and teletype.

Weather Reports

Information on what one can expect in weather conditions is of extreme importance to people who live in a severe climate. The weather reports determine whether they should travel to another community, and whether they will be able to go out to hunt or to fish. The weather reports are also important in determining when and/or if remote communities can expect the arrival of a plane or a ship.

The need for weather information is a two-way need. It is important not only to know about weather conditions in other locations, but also to be able to provide local weather information to others who may be planning to visit the community. It can be expected that as travel to and from a community increases, the need for weather reports will also increase.

The following points are relevant in ensuring an adequate weather reporting service:

- range: The facilities selected for receiving/transmitting weather information must be capable of reaching the intended communities. The intended communities will probably vary as a function of the purpose to which the information is to be put. If it concerns the arrival of ships or planes, one set of communities may most frequently be of interest; if it concerns travel to other communities, or out onto the land for hunting or trapping, the focus will probably be on a different geographic area. Care must be taken to ensure contact with those points most frequently of interest.
- regularity: Partly because weather reports are so changeable, and partly because of the convention that has risen around the business of weather reporting, it is important that the selected system be capable of reliably receiving/transmitting weather reports at regular intervals. With certain types of systems, this may

necessitate that a person be physically present at the operation centre at regularly scheduled times to send or to receive the information; or if the weather reports are received only, it may necessitate some means of automatically recording the information when the operation centre is unmanned.

- training: When the need for weather information is an immediate one -- for example, when there is a need to know whether or not there is a storm in another community -- little or no training is needed to send or to receive such reports. However, when there is a need to predict or forecast weather for the future, some training is required. There are at least three ways in which such training can be helpful.

  (1) knowledge of meteorology can help make weather forecasts accurate;

  (2) knowledge of the terminology in general use by weather forecasters can make it easier to understand weather reports submitted by those at meteorological stations, and ensure that they understand reports transmitted to them;

  (3) meteorological training is a valuable skill that is needed not only in the north, but also in other parts of the world; once acquired, it can form a source of employment.

- two-way/one-way communication: A final point to be considered in selecting facilities for weather reporting is whether there is a requirement for receiving only, or for sending and receiving weather information; different communication facilities can be selected to satisfy each type of requirement.

Depending on the specific needs identified by the community, adequate weather reporting is possible with H.F. radio, teletype, telephone, radio or television. If there are mobile groups in need of such service, trail communications may be appropriate.

Plane, Ship Movements

Especially among the Inuit groups who have gradually changed from a nomadic to a settlement way of life, the arrival of planes or ships has become an important event. Their change in way

of life has meant a generally decreased reliance on the land as a source of food and supplies, and an increased dependence on goods imported from the south. In very small and remote communities, plane or ship arrivals may also be the only means of communication with other parts of the land; they carry mail, and other news by word of mouth.

The requirement for this type of information becomes essential where there is no other reliable means of communication, where there is reliance on such shipments for essential food supplies, and when such shipments are prevented or impeded -- as during storms or during break-up and freeze-up. They also are of importance not only to native groups, but also to non-natives living in the north. At present, and probably for quite a while to come, most construction projects, or projects involving the introduction of new technologies, must rely on the importation of supplies and materials from the south. The schedules for those projects are in turn dependent upon the schedules for arrival of supplies.

It is expected that the requirement for this application would be restricted to those areas not adequately served by highways, and subject to extreme weather conditions. Where there is such a requirement, the following factors will be relevant in the selection of communications facilities:

- range: The area covered by the selected system should include those communities with which there is most frequently a need for such contact; this will probably include ports from which supply ships depart, and also air bases along the route that includes the community.

- two-way/one-way communications: It will usually be necessary that the communication system have a two-way capability, so it will allow for requests for information, as well as for the giving of information. The other option involves a one-way arrangement in which information on plane or ship movements is regularly transmitted to the communities concerned -- either on a regularly scheduled

basis, or as a regular procedure associated with the schedule of the ship or plane.

- reliability: It is important that the selected facility have a high degree of reliability; that is, that it can be counted on to perform whenever required. This factor assumes greater weight under two sets of circumstances:

  (1) where provisions are in short supply and expected shipments form a major source of food and other essentials, it will be extremely important to be able to obtain information on an immediate basis;

  (2) where it is necessary to arrange for assistance in unloading the ship or plane, it is important to be able to call ahead so that delays will not be incurred.

The possible alternatives that could form a communications system to provide information on plane and ship movements include H.F. radio, trail communications, telephone, teletype, and radio.

News of Events, Friends, Relatives; Chatter

There are many factors in the north which conspire to increase the sense of isolation among groups of inhabitants. Great distances, unpredictable weather conditions, and inadequate and expensive means of transportation serve to inhibit travel between communities, so that those living in distant communities may rarely expect to see one another. These circumstances can be extremely difficult for family and friend groupings that have been split up because of moves to new or different communities, or because some members are in a distant hospital, etc.

Communication between communities can be a satisfactory substitute for travel in such cases. Here the need is not for business discussion, nor for emergency purposes; instead, it is a need for some means of keeping in touch, maintaining friendships, and widening the awareness of events in the lives of those who share similar background. It includes conversations between a husband and

his wife who is ill in a distant hospital, news on the progress of a friend who is building a house in a new community, requests for company on a hunting expedition, and idle chatter to dispel the boredom of a long day.

To have this potential is to reduce the great sense of isolation felt by those residents in remote communities. It fosters a sense of identification with those living under similar conditions, and promotes the maintaining of contacts with family members or friends living in nearby or more distant communities. Theoretically, at least, it also leads to a communications system which more closely approximates that found in large southern centres.

- two-way conversation: The selected system should have a potential for two-way communication, and be of a quality that is conducive to casual conversation.

- range: Consideration should be given to determining with which communities there is most likely to be a demand for contact. The selected system should then have the ability to reach those communities.

- access: The system should be of such a design, and in such a location that those wishing to use it may feel free to do so whenever desired. This implies that the equipment can be operated with little or no training, and preferably without the assistance of an intermediary. It also implies that the equipment be located at least in a central, readily accessible site, and preferably in each home.

- reliability: While some latitude in reliability is acceptable, it is important to select a system that will not be subject to extensive periods of malfunctioning or outages. Such gaps in operation can discourage people from using it, and therefore defeat the purpose for which it was intended.

- privacy: There will be many times when the people using the system would prefer to have a private conversation. Certainly, where no facilities exist for casual conversation between communities,

a public facility is better than none at all. However, as people become more accustomed to using communication facilities, it is likely that the demand for privacy will grow.

- cost: It is extremely important that whatever system is selected, that it be inexpensive to acquire and to operate. Especially in areas where family incomes are low, the prospect of a high purchase cost, and high calling charges can effectively serve to inhibit use of a communication system. Also in this application, it may be anticipated that there will be a desire for calls of medium to long duration. It would be preferable, then, that there either be no charges on a per call basis, or that such charges be kept very low.

Among the alternatives which could satisfy this requirement are H.F. radio, telephone, and teletype. One should refer to these sub-sections in the Alternatives section for more information on each.

ALTERNATIVES

The purpose of this section is to provide a basic level of information on the various types of communications systems which could be used to satisfy the requirements for inter-community communications in the north. The information is organized into sub-sections -- each one referring to a different type of communication system. This means that it will not be necessary to read through all the material, but only through those sub-sections on systems which are likely to satisfy specific community requirements.

The information that is presented here is provided in the recognition of an immediate need for communications systems on an interim basis. From what is at present known of communications technology, it would appear that the most satisfactory and comprehensive services for the north will be provided by satellite communications. However, the reality of the situation is that it will probably be quite some time before widespread satellite service will be economically feasible. Tests are being conducted in an effort to explore the potential of satellite communications and to improve the quality and reduce the cost of ground terminals. But it will take time and there are some needs that simply cannot wait. For these reasons then, information on satellites has not been presented, although this is the general direction in which northern communications is headed.

Other points must be made; the overall intent of this report is to help northern communities identify their needs for inter-community communications, and then use this section to evaluate the suitability of each alternative. However, this does not imply that the next logical step would be a move toward acquiring a system. There may be reasons which would lead a community to delay that move for the present. Among the possible reasons, three come quickly to mind as important factors:

(1) The most appropriate option may be simply too expensive; the decision may be to wait until the community has better financial

resources, or until the required system is reduced in cost.

(2) Important technological advances may be anticipated in the short term future; the decision may be that it is better to wait until that technological potential is available rather than to acquire less suitable facilities that will be quickly outmoded.

(3) Responsibility for that area of communications development may lie with some public body. The decision may be to ensure that the public body is made aware of specific demands for extension of service, and to have them effect the required changes.

This final point warrants elaboration because it touches on the issue of private as opposed to public communications systems. In the south, the majority of communications systems are developed, implemented, operated and maintained by publicly regulated bodies such as the common carriers. In the north the lack of carrier provided services has led to the proliferation of private communications systems. These have served to satisfy the needs of some groups in the north, but there are certain inadequacies inherent in extensive private communication nets:

- It does not ensure that a means of communications is available to the general public when needed. Even where access to private systems has been granted, there may be other factors (e.g. language differences, inconvenient or unfamiliar location) which inhibit actual use.

- The net may not be sufficiently extensive as to include locations which the general public may wish to reach. Normally a private system has the capability of contacting locations where there are other representatives of that company, institution or whatever. Whether these are locations which the general public most frequently has need to contact is another question.

- Communication between two communities, both of which have private systems, may be impeded because the two systems are not compatible.

Incompatibility can also have other disadvantages; for example, it may eliminate the possibility of sharing common sources for maintenance and replacement parts.

- Private systems must provide for their own maintenance arrangements. In the case of large organizations that have available to them sufficient funds and technically trained personnel, this may not pose problems. However, less ortunate groups may be unable to obtain or provide the required quality of maintenance service, with the result that their system gradually falls into a state of disrepair.

It is unfortunate that the development of carrier provided and public broadcast services has been as slow as it has. However, in the long run it may be better to give these public bodies the chance to catch up with the demands of the north than to encourage the development of more private systems.

Format of the Information on Alternatives:

There are seven sub-sections on Alternatives, each treating a different category of communication system:

HF Radio
Trail Communications
Telephone
Teletype
Radio
Television
Film

Some of these sub-sections refer to one fairly specific type of system, while others include treatments of related types of equipment and systems. For example, the sub-section on television also covers video-tape recording equipment, and the one on radio includes a discussion of audio tape recordings.

With this exception, the format for each sub-section is the same. Each provides information on one type of communication system under the following headings:

Description
Potential
Training
Cost
Other Information

The final heading: Other Information, is used to explain where and how more information on the topic can be obtained, and to discuss aspects which are specific to that type of system.

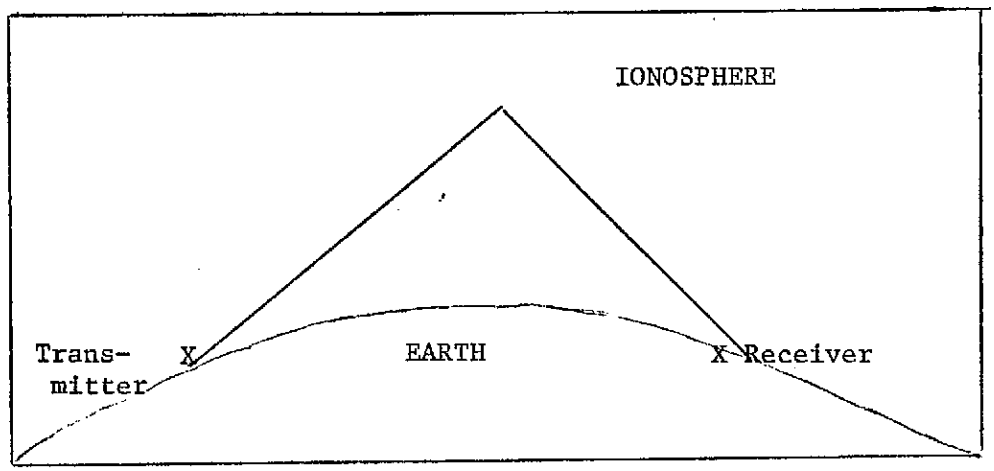
Although there may be those with enough time and patience to peruse the complete section on Alternatives, most will find it preferable to select only those sub-sections referring to systems which are possible options for their own community's needs.

HF RADIO

Description:

High Frequency Radio (commonly known as short wave radio) is a means of communication in which a radio wave signal is transmitted from one point to the ionosphere, where it is reflected back down to another point on earth. The ionosphere consists of layers of ionized gas situated a few hundred miles above the earth; it will reflect high frequency radio waves. The term "high frequency" refers to the number of radio waves transmitted per second, and simply serves to distinguish this type of system from those which transmit at higher or lower frequencies. Diagram 1 illustrates the way in which radio waves are reflected from the ionosphere.

Diagram 1



An HF radio system consists of three basic components: the transmitter/receiver unit (commonly called the transceiver), the antenna and the power source. The transmitting and receiving functions are usually contained in the one unit; the transceiver includes both a microphone and a loudspeaker to allow either function.

The antenna usually consists of a wire or metal rod which is mounted above the ground in a clear space, and which is connected to the transceiver by means of a coaxial cable. When the unit is transmitting, the electrical signals it produces travel through the coaxial cable to the antenna, where they are changed into

radio waves and radiated. When the unit is receiving, the antenna receives radio waves, translates them into electrical signals which travel through the coaxial cable and are heard through the receiver as voice signals.

The power source supplies the power necessary for the various operations of the system. If there are commercial sources of power available, the unit can simply be plugged into a wall outlet. If there are not, it must be attached to a battery, and the battery in turn must be kept charged by means of a battery charger connected to a generator.

An HF transceiver may have a number of channels - often four to six, with each channel tuned to a different operating frequency. Operating frequencies are assigned by the Department of Communications to each radio station. When radios in different communities are assigned the same frequencies, they can communicate with each other, but not with radios assigned different frequencies.

Potential:

HF radio is suitable for communications over long distances because it transmits sky waves which are reflected off the ionosphere. It also radiates ground waves which travel in straight lines near the surface of the earth. The ground waves are rapidly reduced in strength, or attenuated, by interaction with the surface and thus are usually used only for communication over short distances of much less than a hundred miles. The reflected sky waves also travel in straight lines; however, they can be directed so that they reach distant points and are therefore suitable for use between remotely located communities.

HF radio has, however, other characteristics which limit its usefulness for inter-community communication. Perhaps the most serious of these is that it is very prone to interference from atmospheric and other sources. As we noted, it relies on the ionospheric layers of the atmosphere to reflect the signal back to

earth. But the ionosphere itself is subject to considerable variability, and this variability can affect its performance as a reflecting surface. It consists of layers of ionized gas which are formed when the sun strikes the atmosphere; these layers tend to dissipate during the night, but do not disappear completely. Moreover, the ionosphere varies not only in density, but also in distance from the earth. Because of this, it is difficult to predict both the location and the characteristics of the surface to be used for reflection.

Sun spots are another source of the ionospheric variation. Such solar activity is cyclical, so that any HF system which works well at a given point in time will almost certainly need frequency modifications in about five years to compensate for the solar cycle.

There are steps which can be taken to somewhat modify the effect of these factors. The installation of at least four frequencies in an HF system allows flexibility to contend with the vagaries of the ionosphere (more about this under training), and the careful initial selection of frequencies provides the means to cope with the variation due to sunspot activity.

Another set of limitations is posed by the fact that the system does not permit privacy of conversation. When an HF system is available for public use, the equipment is generally located in a convenient building, and anyone wishing to make a call comes to that building during the scheduled hours of operation. If there are others there for the same purpose, he must wait his turn. He then has the operator put the call through, and carries on his conversation. Whatever he wishes to say is not only accessible to those in the radio building, but also to all those in a similar position at the receiving end, and to anyone at any other location who happens to have HF radio equipment with the same assigned frequencies.

One should not assume that the private acquisition of an HF system will allow privacy of conversation. It does not. Although it may eliminate the situation in which people waiting to make or to receive calls can also hear the conversation, it does not

change the fact that all those having access to those assigned frequencies also have access to the conversation.

And, as the report of the Royal Commission on Labrador suggests, the accessibility can at times be still wider:

> ... another severe limitation of the HF network on the Labrador coast is its lack of privacy. Any other radio set with the same frequency can monitor the conversation, while many types of private transister radios can do the same. Indeed, private long distance calls appear to rival broadcast radio as a form of entertainment, at least when reception is good.
> (Report of the Royal Commission on Labrador, 1974)

These factors limit the range of topics which can be discussed over HF radio, and curtail the sense of freedom inherent under less public circumstances. For these reasons (assuming a clear signal is possible) HF radio is not suitable for any communication which contains information which should not or must not be publicly available, or which requires lengthy discussion.

There are also limitations on who can be contacted via HF radio. Generally speaking, communication is possible only between communities having radios assigned the same set of frequencies. This means that there will be nets, or groupings of communities. Within each net, communities can call one another; to call outside the net, however, is a more complicated affair.

If one community has access to more than one net, then that community can act to pass messages from a community in one net to a community in another net. Direct conversation between the two nets will generally not be possible, since the noise on the two systems together can be expected to be greater than the voice signal. Instead, the operator in the community having access to both nets can act as an intermediary, receiving a message on one HF system, transmitting it on another, and reversing the procedure when an answer is obtained.

When there is a need to contact southern centres, or other large northern communities that are not in the same HF system,

it is often possible to use a phone patch in combination with an HF system. In this case, a call is made from one HF radio-equipped community to another which also has telephone service, and an operator in the latter community puts the call through over regular telephone lines. This combination does permit direct communication; however, it is usually necessary to have an operator act as intermediary to switch transmitting and receiving channels as each person finishes talking. It should be noted that this latter limitation can be eliminated through the use of two-way or duplex HF. However, the additional cost is sufficiently high that this feature is usually not included.

It may well be however, that the most frequent demands for intercommunity communication are among a relatively small number of communities, or that combinations of community nets can be arranged to satisfy many of the needs. A good example of the latter possibility is the sub-system structure adopted by the Wa-wa-ta Native Communications Society. As Diagram 2 on the next page shows, the Society has been assigned six frequencies, and the base station at Sioux Lookout has access to all six. The other communities in the system are divided into three groups, based on common interests and communication patterns. Each of these three groups has one channel which can be used to contact other communities within the same group, and two channels which can be used to contact either the base station or communities in one of the other two groups.

The benefits of such an arrangement are that channels suitable for both day and night communication are available throughout the whole system, and that the dedication of individual day channels to the sub-groups permits three conversations to be conducted simultaneously. (One should note that Diagram 2 represents the structure of the system in mid-1973, and does not reflect additions to the system since then; it is included as an illustration rather than as a representation of the actual situation).

One of the characteristics of an HF system (as well as certain other types of communications systems) is that it usually must be attended if it is to be operational. If one community is

trying to contact another, it will be to little avail if there is not someone at the other end to turn the receiver to the frequency on which the first community is transmitting. Chief Recalma of the RAVEN Society has reported that they are able to provide a twenty-four hour service to those wishing to contact the base station because they use four receiving units, each of which they keep tuned to one of their four frequencies, and because they have set up an alarm signal which informs them of an incoming call during the night. (Recalma, 1973)

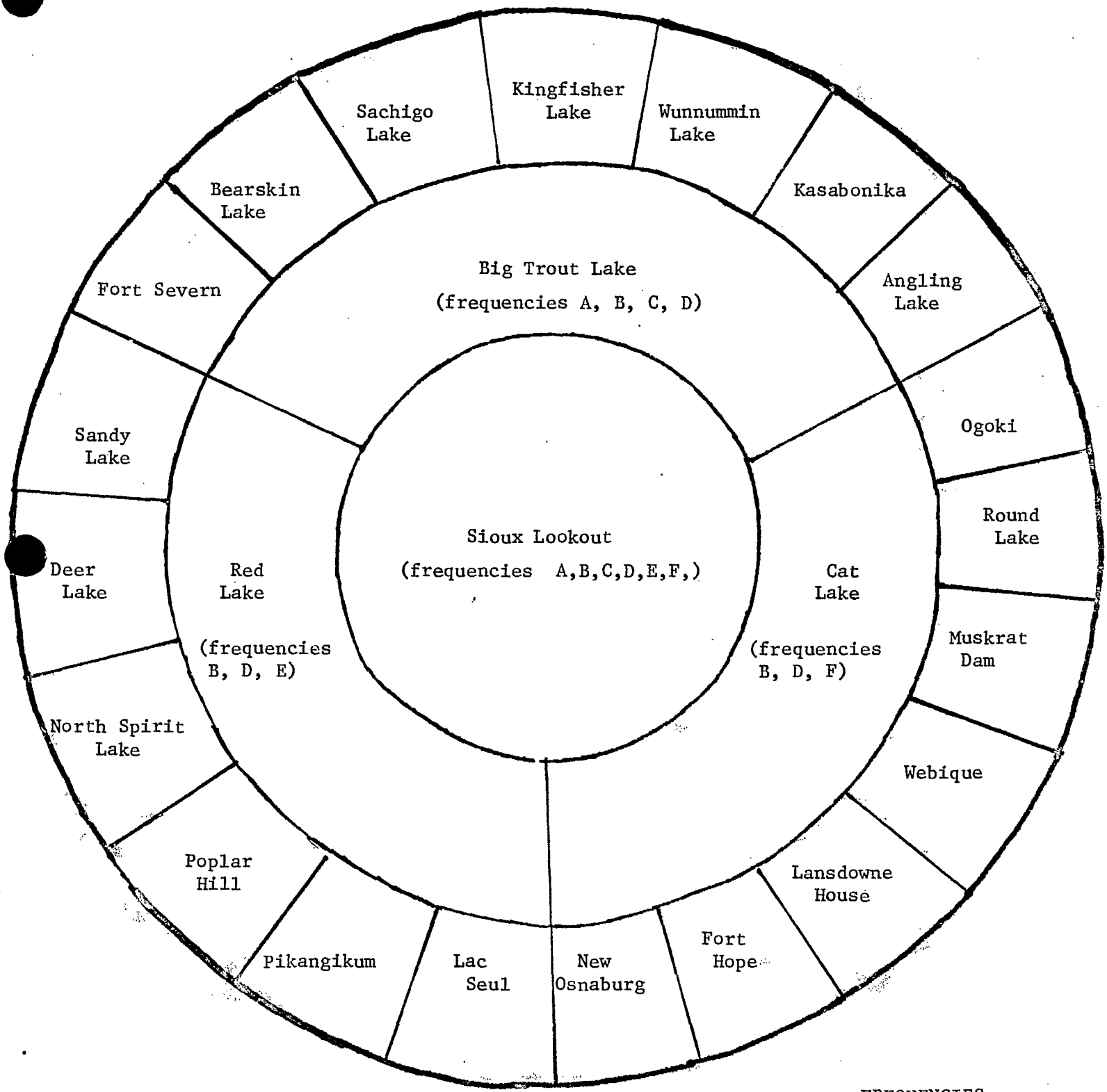
One common method of dealing with this characteristic is to establish a schedule according to which communities in the system agree to attend their sets during specified hours of the day or night. This may be inconvenient for some because of the variations in activities and requirements from one community to another, but it seems to be the most reasonable way to avoid the situation in which hours are spent attempting a call to an unattended station. Another possible future alternative is a simple device which has been proposed by the Department of Communication's Communication Research Centre, to record incoming calls on an unattended HF transceiver.

As for the future, it is to be hoped that HF radio will gradually be replaced by more satisfactory communications systems. There are other types of systems which can provide better quality communications on a more reliable basis; however, the difficulty of installing and maintaining them in the north, and their present high cost, reduces the likelihood of their being made available in the immediate future. HF can provide a limited, and inexpensive means of communication over long distances. The most important role that HF can play is that of a stop-gap measure - to provide communication facilities where none exist and are unlikely to be forthcoming in the short term future, or where the high cost of better systems cannot at present, be afforded. In this role it also serves to familiarize people with the nature and use of basic communications technologies before more advanced systems are introduced.

DIAGRAM 2

STRUCTURE OF COMMUNICATIONS SUB GROUPS (Mid-1973)

WA-WA-TA NATIVE COMMUNICATIONS STUDY



(From: Ontario Region Dept. of Communication Report: "A Continuing Role" ..., 1973

FREQUENCIES

A - 4910 KHz
B - 4987.5
C - 3158
D - 3173
E - 5017 } Tentative
F - 4908.5 }

In summary, the following points can be made about the potential of HF radio:

1. It can be used for communication over great distances and between points separated by geographic barriers such as mountains;
2. its level of reliability is extremely variable, and is dependent on many factors; it can range from a 35 - 40% chance of completing a call in the worst of circumstances, to 90 - 95% in the best;
3. it is subject to interference from atmospheric conditions and sun spot activity; because of this, different operating procedures are required for day versus night, for winter versus summer, and for various times within the eleven-year solar cycle;
4. the use of multiple frequencies within an HF system allows one the required flexibility to handle the different operating procedures;
5. knowledge of the way in which atmospheric conditions and sun spot activity affect transmission of radio waves is important in helping choose the best frequency to be used at any given time;
6. different frequencies must be used for communities that are distant than are used for those that are near;
7. conversations can be held on a frequency only one at a time; if a transmitting/receiving unit has a number of frequencies assigned to it, only one frequency can be used at a time;
8. communication via HF radio can be established only between communities that are assigned the same frequencies;
9. to contact a location outside this group of communities requires the use of an intermediary, either to pass messages or to control operations for a phone patch;
10. privacy of communication is not possible on an HF system - regardless of whether it is available for public use, or operated on a very limited private basis;
11. it is preferable to keep communications brief so that the frequency will be available to others in the system wanting to use it;

it is therefore not suitable for lengthy discussions;

12. HF radio systems are generally easy to use, with a very minimal level of training; anyone can make a system work in some fashion - however, it takes considerably more expertise to make it work well and reliably;

13. the technology should eventually be replaced by more efficient and reliable types of systems, however, this may be some time off in the future; and

14. it can serve a useful role as an intermediate step between the circumstances of having no communications and those of having a more advanced technology.

Training:

There are four basic processes associated with the acquisition of an HF radio system: installation, operation, maintenance and administration. In each of these a certain amount of training is necessary to ensure that the system will operate as required. In most cases, however, the training is easily acquired and does not depend on the trainee having a high level of education or technical expertise.

The installation of an HF system includes the erection of the antenna(s), the connection of the antenna to the transceiver, and the connection of the transceiver to the power source. The difficulty involved in erecting an antenna depends on the type of antenna selected. If a whip or vertical wire type of antenna is used, erection is simple and takes only minutes; however, it does not provide as satisfactory performance as can be obtained with other types.

A more popular type of antenna and one which can provide very good performance is the dipole antenna. As might be expected, erecting a dipole antenna requires somewhat more effort. It consists of a wire or wires, each of which is cut to correspond to one of the frequencies assigned to the system. Each wire is strung

out horizontally between two poles, and its vertical distance from the ground is also related to the frequency to which it corresponds. Generally, higher frequencies require shorter wires positioned closer to the ground.

At least two poles are required and they should be at least forty feet long. If more than one wire is to be attached to each set of poles, the poles must be longer than forty feet, since the wires cannot be positioned too closely together. Holes must be dug in the ground (3 to 4 feet deep), the poles inserted, raised, and supported by means of guy wires. The antenna wires are then erected horizontally, with one end attached to each of the poles.

It is necessary that the antenna be positioned so that it is alligned in specific directions -- e.g., north to south -- to permit the most effective communication with other locations in the system. The exact positioning of the antenna will vary with each system, but one should be aware of this need when selecting the site.

Connections between antenna and transceiver, and between transceiver and power supply are normally quickly and easily managed. It frequently involves simply attaching a wire to another wire or to a connector.

The most difficult part of the installation involves knowing how to position and attach the antenna wires to the poles. This information can be obtained in fairly comprehensible form from the company supplying the equipment. It can also be obtained from a consultant. In many cases, consultants and supplier companies may insist on doing the installation work themselves. Their familiarity with the equipment should result in a top quality job, however, the members of the community will lack the knowledge to cope with any minor problems that arise later.

The best procedure is to have community members involved in the installation -- at least in an observational role, if not in actually assisting with the work. Their involvement should include questioning on why things are done and what the important

factors are affecting operation. It would be wise for community members to insist that installation include training and a set of simple instructions on how to handle minor problems. Participation in the installation can be beneficial in two ways:

- it can help community members recognize when something has gonw awry with the antenna system; and
- if there is an opportunity for the same people to participate in several installations, it will be a form of training that may eventually enable them to skillfully complete installation on their own.

The operation of an HF radio can be both simple and complex. In its most basic form, it involves turning the set on, adjusting the volume, selecting a frequency and pushing a microphone button when speaking. These operations are readily learned by anyone with one simple demonstration. On a slightly more complex level, there may be a need to make additional adjustments depending on the type of unit expected to receive the message, or to tune the unit so as to receive a clearer signal. But again, with a little practice these skills are easily acquired.

The most difficult and demanding aspect of operating HF radio is frequency selection. It is difficult principally because of the variability in the density and height of the ionosphere which is used to reflect radio waves. Because ionospheric conditions change daily and seasonally, it is difficult to set procedures to determine the best frequency to use at any given point in time. One of the few certainties in HF radio transmission is that higher frequencies should be used during the day and lower ones at night. One will note that Diagram 2 on page 45 shows four day frequencies (A, B, E, and F) and two night frequencies (C and D); each community has access to at least one day and one night channel. Much of the ability to select from available HF frequencies is derived through a process of trial and error; however, familiarity with some of the characteristics of radio wave transmission can make the process less of a random one. The following information may be helpful:

(a) During the day, another layer forms along the bottom of the ionosphere. This layer tends to absorb low frequency radio waves, so that they do not get through to the reflecting layers, and are not transmitted back to earth. Because of this, higher frequencies should be used during the day.

(b) At night, the ionosphere is not very dense, so high frequency radio waves are likely to pass through it and not be reflected. Lower frequencies should, therefore, be used at night, since they are more likely to be reflected back to earth.

These are general guidelines which will improve the chances of establishing contact when no other information is available. However, they may not be sufficient to permit high quality transmission in a specific location or between two specific geographic points. In these cases, other alternatives open to the operator include the following:

- a record may be kept to indicate when attempts were made to contact what location, over what channel and with what success; the accumulation of this data will gradually form a tool to predict the possibility of successfully completing a call over a given frequency;
- the federal Department of Communications publishes on a monthly basis, maps and tables which show which are the best frequencies to use for communication between two locations; see "other Information" for address of contact;
- those people who have access to television will soon be able to turn to that medium for guidance in frequency selection. Programs broadcast over the Anik satellite facilities will be punctuated with short "commercials" on the best frequency to use (on a weekly basis) and on other aspects of radio operation.

Use of these various sources of information should not only make for better quality HF transmission, but also take some of the complexity out of the training required for successful HF operation.

Maintenance of an HF radio system will, sooner or later, become as important a factor to the success of the system as are proper installation and operation; for, although the equipment is fairly durable, it will need servicing and checking from time to time to keep it working, and working well.

Most of the maintenance that should be done regularly and frequently is on batteries and generators, and is therefore especially important in those communities not having a reliable -- or any -- source of commercial power. The specific procedures for maintenance will vary with specific brands of equipment, however, the following general points are relevant to battery maintenance:

(a) The connections, or the points at which the wires leading from the transceiver are connected to the battery, must be kept clean. As the battery is used, a corrosive substance builds up around the connections which can block the flow of power. To prevent this, the connections should be cleaned (with steel wool or sand paper) whenever the substance is noticed.

(b) The battery must be kept charged to a certain level. An instrument known as a hydrometer, or battery tester, can be used to determine the level of charge of a battery. It must be recharged if it is below a certain level, but it is also very important that the battery not be over charged. To recharge a battery, one simply connects it to a battery charger. There are certain types of battery chargers which can be left connected to the battery, and which will automatically recharge it when the charge falls below a certain level.

(c) As a battery is charged, some of the water in it is lost and it will be necessary to replace the water. This means that there should be a regular check on the water level, and that more water should be added when it falls below a certain point. The battery charger in turn receives its power from a generator.

Most generators now in use are gasoline run and their operation can be expensive in areas where gasoline is difficult to obtain and high

in cost. Unfortunately, they are frequently the only alternatives in communities that do not have access to commercial electrical power. During the Northern Pilot Project, an HF radio system was installed in Northwestern Ontario. The training manual used in the project provides information on what and when inspection and maintenance was to be carried out on the specific type of generator used in that project; this information is shown in Table 1.

TABLE 1

Frequency of Maintenance Tasks for Generator

Task	Initial 20 hrs.	Every 20 hrs.	Every 100 hrs.	Every 200 hrs.
Oil Check		X		
Oil Change	X		X	
Cleaning of Air Filter		X	X	
Spark Plug Cleaning and Adjustment			X	
Cleaning of Combustion Chamber				X
Adjustment of Ignition Timing				X

Although the instructions included in the manual refer only to one brand of generator, the maintenance tasks listed above are required on most types of gasoline-driven generators. The tasks do require a certain amount of training, as well as demonstrations with actual equipment. It is also important that those responsible for maintenance have available to them a permanent record of the procedure to be followed - either in the form of written instructions with illustrations, or a videotape. This can serve as an aid to reviewing certain operations which may be forgotten over time and it can be a source of information for someone who unexpectedly must do the maintenance, and has not received prior training in it.

In addition to the battery and generator, the other parts of the system also require the maintenance, although on a less frequent basis. The various parts of the antenna must be checked to ensure that all connections are intact and properly oriented; and the connections and fuses in the transceiver should also be inspected on a regular basis. A report by the Ontario Region Department of Communications (1973) recommended that on an annual basis, an inspection of the transceiver and related equipment be carried out by a qualified technician as preventative maintenance, to avoid problems later.

With regard to maintenance procedures, one should be mindful of the fact that from time to time it will be necessary to replace a part, or to replace the whole system if it should prove to be defective. If the parts must be imported from a distant location, the radio set may be inoperative for weeks. To reduce the possibility of this happening, the following steps can be taken:

- a supply of spare parts and accessories can be maintained in a community easily reached by other communities in the system;
- the same brand and model of various parts of the set can be acquired by all communities in the system so that a common pool of spare parts can be used for all sets;
- the base community could acquire an extra set in case it becomes necessary to remove a complete set from a community; this would avoid having that community go without communications while their set is being repaired.

The use of an HF system also involves following certain administrative procedures required by the Federal Government. In most countries, the use of the radio frequency spectrum is controlled by the government so as to ensure that it is employed most efficiently, and so as to avoid interference among its various users. Such regulation is necessitated partly because of the nature of the radio frequency spectrum. It may be considered as consisting of bands of radio waves -- some are low frequency bands, some high frequency bands,

some very high frequency, etc. Each of these bands is most suitable for certain types of communication, and not for others. Moreover, with the general increase in communication throughout the world, there has been an increase in the demand for access to the radio frequency spectrum -- particularly within certain bands or certain types of communication. Rather than have prospective users battle it out among themselves with the result (as in the early days of radio) that one is likely to receive little other than interference from other users, governments regulate access to and use of the spectrum. There are international agreements which allocate the use of specific frequencies to specific countries, and there are also restrictions as to the types of use to which each segment of the spectrum can be put. Because it must satisfy these international agreements, and because it wishes to obtain the most efficient use of the radio frequency spectrum, the Federal Government makes certain requirements of those who use the radio waves.

The regulations that apply to the HF range of the radio frequency spectrum cover four general areas:

- operators' certificates
- station licences
- records of communication
- content of communication

Operators' Certificates:

These are certificates that demonstrate that the person responsible for HF radio operation has reached a certain level of proficiency in radio operation. To obtain a certificate, it is necessary to take and to pass an examination set by the Federal Department of Communications. The purpose of requiring a certificate is to ensure that use of the systems will not be abused, and that communication between systems will be facilitated by having all operators follow the same general procedures. To obtain more information on the operators' certificates -- for example, what sort of questions are asked, and where to apply -- see the "Other Information" section.

Station Licences:

Just as operators must be approved, so too the equipment they use must be approved. The Department of Communications also licenses stations -- after determining that the station equipment is of an approved type, and of a quality acceptable for licensing. The licensing process also includes assigning specific frequencies on which the station may operate. Once obtained, the licence must be displayed near the equipment. In the "Other Information" section, one will find information on where and how to apply for a licence, and on the fees that are charged.

Records of Communication:

As a means of ensuring that the HF system is not being misused, it is required that each station maintain a record of all station activity, including hours of operation, summaries of incoming and outgoing calls and the frequencies on which they were received or sent. Written logs of station activity must be retained for ninety days and tape recorded logs for thirty days; the logs must be kept available for possible inspection by Department of Communication personnel during these periods.

Content of Communication:

As mentioned previously, HF systems offer little or no privacy of communication; because of this, certain regulations exist to protect both the intended communicants and those who unintentionally overhear the conversation. The latter are required by law to preserve the secrecy of communications; it is not permissable to deliberately attempt to intercept a message intended for another, nor is one permitted to reveal the content of a message intended for another, if it should be accidentally intercepted. On the other hand, the intended communicants are forbidden to use profane or offensive language, since it may be accidentally overheard by others.

The above are requirements imposed by the Federal Government. There may be other administrative procedures which the various stations may wish to impose on themselves. For example, they may wish to set up a schedule of hours during which an operator

will attend specified frequencies; or they may want to schedule certain hours when some of the committee can use one frequency and not others; or they may wish to specify what kind of messages can be sent or received (e.g., announcements only, no private conversation). These are decisions that will be made collectively by those communities participating in the system.

Cost:

The purpose of this section on cost is to identify the types of charges which might be expected to be incurred with the acquisition of an HF radio system. An attempt will be made to specify the amount as well as the type of such charges; however, at times this will be difficult to do, since costs vary with the distance from the manufacturer, with inflation, with different manufacturers, and as a result of the particular material and expertise already existing within the community. For these reasons, the costs quoted here should be taken as fairly reliable indicators of possible costs, rather than as actual costs. To determine the actual figures for any specific community or group of communities, it will be necessary for those responsible for the acquisition of a system to assess (perhaps with the aid of a consultant) such variables as the costs of transportation and freight, and the local resources which might be used.

The cost of an HF system can be looked at in terms of three types of charges: those for equipment, for salaries and for operating costs. Each of these three types of charges can be further specified into the following categories:

Equipment	Salaries	Operating Costs
Transceiver Units	Training	Building Rental
Antenna Kits	Installation	Building, heat, light
Antenna Accessories	Operation	Gasoline for Generator or Electricity
Power Units	Administration	
Misc. Tools	Maintenance	Office Supplies
Replacement parts	Consultant's Fees	Licence Fees
Freight Charges	Transportation	

There are two Canadian suppliers of Canadian manufactured HF radio equipment: Canadian Marconi and Spilsbury-Tindall. Each supplies a variety of different types of transceivers and antenna kits, although we will discuss only a few of them here. They are intended to provide an idea of the sorts of costs that are involved.

Canadian Marconi manufactures two models which (among others) would be suitable for use in the north:

- Marconi Model CH25, complete with one simplex channel, microphone and manual, operates off 115 volt AC circuit $1,550
- Marconi Model CH25, complete with one simplex channel, microphone and manual, operates off battery: 12, 24 or 32 volts DC 1,655
- Each additional simplex channel 75

If, for example, one wanted an HF system which could be plugged into an electrical outlet from a commercial power source, the transceiver unit would cost $1,775 for four channels ($1,550 + $75 X 3) or $1,925 for six channels ($1,550 + $75 X 5).

If a dependable source of commercial power was not available, it would be necessary to select the unit which operates off a battery, and in this case, it would cost $1,880 for a transceiver with four frequencies ($1,655 + $75 X 5).

Marconi manufactures an antenna kit which sells for approximately $70. It consists of antenna model MO2-RM ($54) and mount model 43-D ($13).

It should be noted that the above quoted prices are as of August, 1974, and valid for orders of from 4 to 10 units. If less than four units were to be purchased, the prices would be higher, and if more than ten units were to be purchased, it is possible that slightly lower prices would be charged.

Spilsbury - Tindall manufacture a transceiver unit which is approximately equivalent to the above Marconi equipment:

- Model SBH125: basic unit (includes microphone and battery holding tube, but not battery) up to six channel capacity, 100 watts $2,184
- Plus per simplex channel installed 78.50

The above unit can be ordered to operate off a commercial power supply - either 115 or 230 volts AC, or to operate off a 12, 24 or 32 volt DC battery. A converter, which allows the flexibility to operate off either type of power supply, costs approximately $140.

If one were to have four channels installed, model SBH125 would cost $2498 ($2184 + $78.50 X 4) and to have six channels installed, the unit would cost $2655 ($2184 + $78.50 X 6).

Spilsbury-Tindall also manufacture a dipole antenna which can be used with any of these transceivers. The model number is STA133, and the cost is approximately $52.

As with the Marconi equipment, these prices are as of mid August, 1974, and for the Ottawa area. One would have to add federal sales tax, and attempt to determine the freight charges for specific communities.

Certain antenna accessories are also required to properly and completely install the antenna. These include items such as insulators, grounding wires, coaxial cable to lead from the antenna to the transceiver, etc. In mid-1973, the cost of such accessories for the Sioux Lookout base station of the Wa-wa-ta Native Communications Society was found to be $280.53 (Ontario Region Department of Communications, 1973). With approximately 10% inflation, one would now expect the cost of these accessories to range around $310.

Power units will be required for those communities not having access to a reliable source of commercial electricity. The transceivers must then be hooked up to a battery; the battery is kept charged by means of a battery charger, and the charger is in turn powered by a generator. Twelve volt batteries can be obtained from Canadian Tire for approximately $26 to $42., and Canadian Tire

battery charges cost approximately $35. A gasoline operated generator (model E300) is available from Honda at $285. One would then expect the cost of the equipment for a power unit to range from $340 to $355.

Other miscellaneous tools will also be required to complete installation of an HF radio system. The Ontario Region Department of Communications (1973) estimated that approximately $140 was spent in Sioux Lookout on items such as drills, sledge hammers, soldering irons, ladders, etc. If we allow for an inflation factor of approximately 10%, one would expect the same equipment to cost approximately $155 in mid-1974. It should also be noted that depending on the resources already available in a specific community, the required expenditure may or may not be as high as that in Sioux Lookout.

The amount spent on replacement parts will also vary from one community to another. From time to time, one can expect failure in some part of the equipment - either because the equipment has completed its expected life cycle, or because of weather conditions or accidents. It will be advantageous to have the required replacement part readily available, but whether each community keeps its own replacement parts, or whether one or two communities in the system keep the spare parts for all, is a decision to be made by the communities. Whatever the choice, the parts most likely to be needed include fuses, batteries, and various antenna accessories, such as guy wires. In case of more serious failures, the communities might want to keep available a complete unit, including transceiver, antenna kit and power supply. This would be a costly investment, but might well avoid having some community go without communications for an extended period of time.

Similarly, freight charges will also vary from one community to another. None of the above quoted equipment figures include freight costs; they represent costs in Ottawa. If equipment is required, those responsible for the acquisition should contact the nearest supplier, and with their help, determine the additional amount to be charged for freight. It will vary depending on the distance from the supplier to the community, and the available means of transportation

between the two points.

In summary, the expected equipment costs excluding poles, for an HF system would be approximately as shown below for each community:

Equipment	Approximate Cost
Transceiver Unit	$1775 - $2655
Antenna Kit	52 - 70
Antenna Accessories	310
Power Units	346 - 362
Misc. Tools	155
Replacement Parts	+?
Freight Charges	+?

The costs for salaries are much more under the control of those responsible for initiating the system. They must decide who is going to train and who will be trained, who will be responsible for installation, and who will operate, administer and maintain the system. To the extent that expertise in these areas already exists in the communities, there will be flexibility in deciding the salary to be paid for each function. When such expertise is not available, or is insufficient, outside help must be brought in, and salaries are less flexible.

Two areas in which it is likely that outside help will be required are training (in operation and maintenance), and installation. The two most common sources of such help are companies manufacturing and distributing HF equipment, and communications consultants. It would be necessary to contact each in regard to a specific job to determine what services they would supply for what cost. As mentioned earlier, when outside help is brought in, it is often beneficial to have the participation of community members - whether through observation or more direct involvement. This will increase the probability of having someone immediately available for help if something should go awry with the equipment or its operation. The more that community members know about their system, the better.

In some cases, community members have relied on unpaid volunteer help for the installation and operation of their HF system.

This is an inexpensive means of supply-ng a needed service to the community. However, although it may be satisfactory for short term projects (e.g., attendance at a training session, help in installing an antenna), it may not be a prudent approach to longer-term ongoing functions. Not only is it rather unfair to expect someone to operate or maintain an HF system on a daily basis without pay, but also it invites problems. A volunteer worker is more inclined to neglect his duties for other activities, and having different people working the system makes its operation more variable, since some people will be better at operating or maintaining it than others.

For these reasons, it is advisable that each community retain a person on a salaried basis to be responsible for the operation, administration and maintenance of the system. The salary will depend on the resources of the community, and on the specific services performed by the employee, but it is likely that it would be at least $5,000 - $6,000 per year. The functions performed should generally include those mentioned in the previous sections under Training.

The group of communities connected by the system will probably also find it beneficial to have one of the communities act as a base station, and to have much of the administration for the whole system taken care of from there. The following functions could be performed by a base station:

- liaison with suppliers and consultants regarding acquisition, installation and operation of HF system
- facilitate communication between those included in the system and those outside, provided the base station has access to another communications system, whether telephone, a second HF system or whatever
- set up schedule of hours of operation so that base station would be continuously operational, while other communities would be operational only at specified times, on specified frequencies

- order, store and distribute as required, replacement parts for the HF equipment in the other communities
- other administrative tasks, such as licence renewal and the training to qualify for the operator's certificate.

To handle these responsibilities, a communications system manager could be appointed at the base station. Again, the salary for this position would depend on the resources available to the communities in the system, but one might expect it to range around $8,000 to $9,000 per year. In addition, secretarial/clerical help would probably also be required, and this could be expected to cost $5,000 per year, although perhaps part time help would be sufficient.

One will notice that on page 61, the items "consultant's fees" and "transportation" have been specified under salary costs. Some communities may feel they can manage quite well without the assistance of a consultant; others however, will find it well worth their while to engage the services of a consultant at the beginning of the project to help select and install the system, and at regular intervals, to check the equipment for potential weaknesses. Those who do elect to engage a consultant should include in their budget about $100 per day for his fees, plus about $300 - $500 for his expenses (this will vary depending on the distance he travels, and available accommodation).

A proposed budget for an HF system should also include provision for transportation charges associated with the system. This is intended to cover the costs of sending community members to training sessions, of travel expenses for installers and repair men, and of the visits of the communications system manager to each of the communities in the system. Not every community or group of communities will have all of these expenses, and the specific cost of such charges will depend on how many people have to travel how far, by what means, and how often. When planning the costs of an HF system, it is important to consider these questions and to try to estimate realistically what transportation expenses might be incurred.

The operating costs for an HF system are also subject to considerable variability from one community to another, again depending on the resources available in the community. The costs most subject to variation are those associated with the building in which the equipment is housed, and with the supplying of power to operate the equipment.

In some communities, a building may already exist which could be used for the radio; in other communities, it may be necessary to buy, rent or build space to house the equipment. So the cost could range from zero to the price of a new building. In surveying potential community sites or structures, the following should be kept in mind as important factors in the selection of a location:

- The antenna for the radio requires a large, high open space; it is not unusual for 150 to 200 feet to be required between the antenna poles.
- The antenna must be located relatively close to the building which houses the radio; if not, power will be lost between the antenna and the transceiver, making communication difficult to impossible. (An alternative is the addition of a power amplifier, which could cost up to $5,000 more).
- The equipment should be located away from traffic, as engine ignitions in snowmobiles and other vehicles can cause interference.
- The building must be large enough to house those coming to make calls, as well as those responsible for operation.
- The building should be conveniently located and otherwise readily accessible to potential users. It should, therefore, be located close to the homes of community members, and in a building community members are likely to visit. (One community selected a coffee shop; this may be too noisy or too public, or just right for others).

It is quite likely that some communities will be unable to find locations to satisfy all of these requirements; in these cases, a compromise will have to be reached. Estimates for radio housing

costs should be made after considering the suitability of available resources.

Similarly, the cost of heating and lighting the building will depend on available sources of power and rates charged in each community.

Where there are commercial sources of electricity, the cost of operating the HF radio equipment will probably be included along with the lighting for the building (and perhaps also the heat) on the electricity bill, and will vary with local usage and rates. Where commercial sources of power are not available, a gasoline operated generator is the most common alternative, and the required gasoline can be quite expensive. For example, the Wa-wa-ta Native Communications Society (1974) has found that it costs about $720 annually to supply gasoline and oil to each community using a generator as a power source. This cost will fluctuate as the price of gasoline varies from one part of the north to another.

It would probably be appropriate to note at this point that there are generators which operate off sources other than gasoline. Robbins (1974 a) has examined the possibilities of wind, solar and catalytic power supplies and has evaluated a number of wind charging generators. Although they are considerably more expensive (probably $1800 - $3300), and would be appropriate only for communities with appropriate wind characteristics, they might prove to be a viable long term alternative in certain areas. Certainly, the increasing cost of gasoline (which already ranges from $1.25 to $2.50 in the north) should serve as a goad to more serious investigation of this possibility.

Miscellaneous office supplies include various items such as forms for the keeping of radio logs and other records, stationery, pencils and pens, postage, typewriters, etc. This cost will be minimal (approximately $25 per year) in those communities with relatively little administrative responsibility and will be more important in communities which act as base stations. In base

stations, the added costs of typewriter rentals, or photocopying, and of telephone charges, could well increase the office costs to $3,000 per year.

Finally, radio licences are renewable on an annual basis, and a fee of $20. per radio is charged.

HF radio can be a relatively cheap undertaking and may be satisfactory in those areas with little money and no other means of communications. However, as can be seen, it has some major disadvantages, and the steps required to make it work well can add significantly to the cost.

Other Information:

Before one can legally operate an HF radio, it is necessary to obtain an operator's certificate. This demonstrates that the operator has studied certain basic information on radio operation and knows the conventions of radiotelephone usage throughout the world. In most cases, it will be sufficient to obtain what is termed a "Restricted Radiotelephone Operator's Certificate". To do so, it is necessary to know certain material on radiotelephone operation, and to pass an oral examination which is given by a representative of the federal Department of Communications.

Information Canada distributes a little booklet which can be used to study for the examination; it is called "Radiotelephone Operator Handbook" (Catalogue No. Co22-173) and can be purchased for $0.75 from any Information Canada Bookshop. For example, one could write to Information Canada at any one of the following addresses:

- 393 Portage Avenue
  Winnipeg, Manitoba
- 800 Granville Street,
  Vancouver, British Columbia
- 640 St. Catherine St. West,
  Montreal, Québec
- 171 Slater Street,
  Ottawa, Ontario

When the contents of the booklet have been studied, the prospective radio operator arranges to take the exam. The examination is an oral one, given by a regional inspector of the Department of Communications. There is also a hearing test to determine

how well the person applying for the licence can hear. To make an appointment to take the test, write (or phone) the nearest field office of the Department of Communications. If the nearest field office is not known, write to a regional office, and they in turn will send it to the field office. Four of the regional offices can be contacted at the following addresses:

Regional Office,
Communications Canada,
One Lombard Place,
Winnipeg, Manitoba,
R3B 2Z8.

Regional Office,
Communications Canada,
325 Granville Street,
Vancouver 2, B.C.,
V6C 1S5.

Regional Office,
Communications Canada,
2085 Union Street,
Montreal 111, P.Q.,
H3A 2C3.

Regional Office,
Communications Canada,
55 St. Clair Avenue East,
Toronto, Ontario,
M4T 1M2.

The regional inspectors are usually fairly flexible in trying to arrange appointments to satisfy the needs and schedules of those wanting to take the exam. There is no charge for the examination or for the certificate.

A radio licence must also be obtained for each radio. It demonstrates that the radio can satisfy certain technical criteria to perform as well as it should, and that it can be used for communication over specified frequencies. It is important that the radio operate at the frequency to which it was assigned, or it can interfere with the communication of other HF radio systems.

To apply for a radio licence, it is necessary to fill out a form, and to send it to a regional or field office of the Department of Communications. However, usually the company which supplies the HF radio equipment has a supply of the required forms, and they will frequently help in filling it out. Because the form tends to be fairly complicated, it is better to take it to a field office than to send it. If information is missing, it can then be added immediately, instead of having to send it back and forth between the applicant and the office.

The fee system too is a bit complicated, and the amount charged depends on the type of equipment and the use to which it is

put. Generally, if an HF radio is used for private conversation between communities, the licence fee is $20.00 per radio. (If there are mobile units, each unit is licensed at a fee of $7.50, and the base station for $20.00). If the system is used for air or sea navigation as well, there is an additional $20.00 charge. The inspectors in the field office can determine the amount to be charged in each specific case. Once the radio is licenced, the same fee must be paid every year, provided the equipment and usage remain the same.

To turn to a different topic now, the use of an HF prediction service can help HF operators select the best frequency for communication at various times of the day and year. As mentioned earlier, when an HF radio is equipped with, for example, four or six frequencies, it has a better chance of completing calls than when it has only one or two frequencies. However, the difficulty comes in knowing which frequency to use when. The Department of Communications has a computerized HF prediction service which indicates the best frequency to use for HF communication between two given points. With this information, one can then select the frequency on his set which is closest to the predicted best frequency. This should eliminate a lot of the guesswork from frequency selection.

Anyone can be put on the mailing list to receive this HF prediction information on a regular basis. The Department publishes two types of information:

(i) contour maps: these are centered on the Department of Communications base stations, most of which are in more southerly locations; these maps can be used to determine the best frequency to use when placing a call to one of the base stations;

(ii) charts: these are available for pairs of communities anywhere in Canada; they indicate the best frequency to use for HF communication between any two communities.

The predictions of the best frequencies change each month, so there are different maps and charts for each month. However, the information is mailed out only every three months. There is no charge for this service.

To receive this information on a quarterly basis, one should send his name and address with his request to the following address:

Telecommunications Regulatory Service
Engineering Support Division
1241 Clyde Avenue
Ottawa, Ontario
K2C 1Y3

Attention: H.F. Prediction Service

It is also important to indicate the names of the communities with which one wishes to communicate.

One final note on HF systems: They can serve a useful function in areas where there are at present no other readily available means of communication, but they will be found increasingly unsatisfactory as community needs become more sophisticated. They should be regarded as interim measures, and an attempt should be made to make the units work as well as possible with a minimum amount of financial outlay. Knowledge of the equipment and of how it operates is one of the best ways of attempting this.

TRAIL COMMUNICATIONS

Description:

Trail communications refers to radio communications equipment which is light enough in weight to be easily portable. It usually makes use of the high frequency range of the radio frequency spectrum and so in many ways it is similar in operation to the equipment described in the section on HF radio. Its basic components include a transceiver, antenna and power supply. In order to allow portability, however, the transceiver should be small in size and light in weight; the antenna is frequently a vertical whip type, or simply a long wire; and the power supply consists of batteries and must also be light in weight.

Trail communications are intended for use in situations in which persons are away from their base community for extended periods of time and are travelling in areas that do not have communications facilities that permit contact with the base community. For example, they are needed when groups of people leave the community to go hunting or trapping on the land, or when they go fishing on the sea and are away for days or weeks at a time.

The most appropriate uses for trail communications are for emergency purposes, and for simply keeping in touch with the base community. In the northern parts of Canada travel out onto the land can be a means of obtaining additional income from hunting and trapping but can also be a risky undertaking. If an accident should occur, or if a snow vehicle should break down, it is quite unlikely that help would be forthcoming unless some means of communication were available with which to summons aid. A trail radio can prove to be invaluable under such circumstances. It also allows travelling community members to maintain contacts with friends and relatives in the community - for simple chatter, or to prevent worry.

Trail communications can also be used - though perhaps not as effectively - for announcements of meetings and for certain aspects of band and council business. For example, when community leaders or decision makers are away from the village, trail communica-

tions provides a means for those in the community to consult with or to recall them if an important issue should arise. Similarly, when members of the general community are travelling, the community leaders may wish to inform them of important meetings or decisions.

A trail communications system is usually organized so that there is one base radio unit located in the community, and a number of portable radios made available to groups as they travel out from the community. The base station is usually responsible for distributing the mobile units as requested, and serves as the main point of contact for the mobile units.

Potential:

Portable radio communications equipment can be manufactured to operate in either the high frequency (HF), the very high frequency (VHF), or the ultra high frequency (UHF) bands of the radio frequency spectrum. Each of these bands of frequencies has characteristics that make operation in them more appropriate for some applications than for others. Each band could be used for trail communications in the north, but equipment operating in the HF range is felt to be the best alternative for the following reasons:

(i) HF has a greater range; because the HF sky wave uses the ionosphere as a reflector, it can cover hundreds of miles, while VHF and UHF make use only of ground waves and can cover about 10-30 miles;

(ii) The coverage area of VHF and UHF equipment tends to end rather abruptly, so that a system may be functional at one point, but inoperative a mile or two away. This may not only restrict travel, but may also be dangerous if the equipment is needed for emergency purposes and has been carried beyond its range. HF may fade in and out at various times, but VHF and UHF are quite useless when carried outside their coverage areas.

(iii) HF is less subject to blockage by terrain obstacles; its ground waves will travel around and over obstacles such as

hills. VHF and UHF radio waves need a line of sight path, and especially in the UHF range, are likely to be blocked by hills, forests, etc.

(iv) VHF and UHF can be made to cover longer distances through the installation of relay stations. However, this is extremely costly, and not particularly appropriate for use with portable units.

For these reasons, then, the following discussion of trail communications will be confined to HF trail equipment. Because it is simply a portable form of an HF system, its potential is essentially the same as that described in the previous section on HF radio. For greater detail, one is referred to that discussion, but the information can be summarized as follows:

1. Trail communication is a portable form of two-way audio communications. It permits contact with other units assigned the same frequencies; only one frequency can be used at a time, and only one conversation can be held at a time over any one frequency.
2. It is subject to interference from atmospheric conditions and sun spot activity. These factors will cause the quality of the connection to vary from nil to quite satisfactory. The use of multiple frequencies allows one to switch frequencies as conditions change, and therefore improves the probability of establishing contact.
3. There will be some background noise, and the connection may fade in and out.
4. It can allow contact between locations that are relatively close, or hundreds of miles apart.
5. It does not permit privacy; and it is not particularly suitable for lengthy conversations.
6. It is easily carried, quickly and easily set up.
7. It requires access to a supply of batteries and/or a generator or other source of power which can be used to recharge the batteries.

Like the HF radio systems described previously, trail communications can be made more effective through increasing expertise in frequency selection. This implies a need for knowledge of radio waves and their propagation with various types of antennae, for although it can easily be made to work, it takes more skill to make it work well.

Training:

It will usually be possible for anyone to learn how to install, operate and maintain trail communications equipment within a few hours. The installation consists almost entirely of setting up the antenna. A long wire type antenna has been found to provide better performance in reception and transmission. The wire is pre-cut to correspond to the frequencies assigned to the system, and is strung out between trees or whatever other objects might be available. It is a directional antenna, i.e. it should be set up broadside to the direction in which one wants to send and receive signals. The vertical or whip type antenna generally gives less satisfactory performance, but may be the only alternative where there is no tree cover, and no other way of stringing out a wire antenna. To set up a whip type antenna, it is necessary simply to extend it to full or desired height. Connecting the antenna to the transceiver completes installation.

Operation of trail communications equipment consists of turning the transceiver on, selecting a frequency, pressing a button to talk, and adjusting volume as required. These are the basic operations; there may be others depending on the particular type of equipment selected. When there are multiple frequencies installed in the transceiver, the reliability of the system increases, but it is also necessary to learn to select the most appropriate frequency at any point in time. In general, higher frequencies should be used during the day, and lower ones at night. Skill in the selection of frequencies, and in general operation of the system comes with experience and with knowledge of the nature and radiation patterns of radio waves.

Much of the maintenance of trail communications equipment is oriented toward determining that the power supply is adequate. Some systems will take flashlight size batteries, while others will require larger ones. In either case, checks must be made to ensure that the batteries are neither under nor over charged. Especially with some flashlight batteries, one may have no indicator of the level of charge other than knowledge of the amount of time the batteries have been used. In this case it will be necessary to monitor uses so that one may determine when to replace or recharge batteries.

Not all batteries can be recharged; some are meant to be thrown away when their level of charge drops below a certain point. This may appear wasteful, but may be the only alternative where there is no power supply to recharge the batteries. The rechargeable type make use of a battery charger and either a generator or commercial source of power for recharging. Perhaps the most important ongling maintenance function involves seeing that there are either fresh non-rechargeable batteries or that batteries are kept charged at an acceptable level for each trip on which the equipment is used.

Other routine maintenance includes checking that connections are secure, that the antenna is oriented properly, and that the fuses are not blown. These and the above are easily learned; however, if the system does not work properly when these measures have been taken, then a more detailed technical examination is probably necessary. This would require the assistance of someone with a relatively high level of technical expertise - either someone from outside the community, or someone within the community who has received special training in this type of maintenance.

From an administrative point of view, a trail communications system must follow procedures similar to those set down for other HF radio systems. The operators must be certified; that is, they must pass an examination in radio communications, and the radios - both portable and stationary - must be licensed. There is no charge for the operator's certificate, but the licence fees will cost $20.00 for the stationary unit in the base community, and $7.50 for each

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mobile unit. For more information on where and how to apply for both operators' certificates and radio licences, see pages 71-73.

Communication records should be kept at the base station to show the time, frequency, nature and source of all calls over the system. Because most of the units are portable, the base station should also maintain records to show who has each mobile unit, when it was checked out and when it is expected to be returned, and the approximate appropriate location to which it will be taken. It is important also that the base station establish a schedule of operation, so that mobile units will know when they can expect to establish communication and over what frequencies.

Cost: Again, there are two suppliers of Canadian Manufactured HF trail communications equipment: Spilsbury-Tindall and Canadian Marconi. Spilsbury-Tindall produce a model SBX11, which is a ten watt unit having a capacity of up to four channels. The cost of the basic unit - which includes microphone and battery holding tubes, but not batteries - is $845.50. Each simplex channel installed costs an additional $58.25. So, the purchase price of an SBX11, with four channels installed, is $1078.50 (F.O.B. Ottawa, Aug. '74). It operates on nine flashlight batteries.

If one were to select a vertical or whip type antenna, Spilsbury-Tindall's model STA210 weighs about six lbs., and costs $166.75. They also produce a wire antenna - model STA133, which weighs less than two lbs., and costs about $52.00.

Canadian Marconi manufacture a similar unit - model CP34, which has a power output of 20 watts. The basic unit, with one channel installed and manual, without batteries, costs $1,175. Each additional channel costs $25. With four channels installed, the

purchase price of the CP34 would then be $1250. (F.O.B. Ottawa, August '74). They also package a set of nine rechargeable batteries for this unit, which cost $99; and a battery charger which operates of 115 Volt AC power source, and which costs $62.00.

A portable whip antenna for the CP34 extends seven feet, and costs $79; a long wire type antenna costs $24, and a dipole antenna costs $65.

Other Information: The problem of choosing the best frequency on trail communications equipment may be somewhat more difficult than for HF equipment permanently located in a community. When travelling, it is inconvenient to keep records of calls, and it is difficult to build up a log of successful calls with frequencies and times because the location of the mobile groups continually changes. The Department of Communication's HF prediction service will also have limited utility, since it is oriented toward community use. In the absence of other assistance, it will frequently be necessary to work by trial and error, using the general rule of higher frequencies during the day and lower ones at night.

Because of the possibility that trail communications may be needed for emergency purposes, care should be taken to ensure that at least one person in the mobile group has received training in HF operation and maintenance. The training should include more than the basic steps of operation; it should involve learning how the various factors of time, distance, and direction can affect communication; how the orientation and set up of the antenna can be influential; and how to do on the spot maintenance checks of the equipment.

TELEPHONE

Description: Telephone service refers to a means of communication in which callers can be connected with one another by means of lines and equipment supplied by a common carrier. Common carriers are companies which are given by the government, the responsibility to provide communications services in those circumstances where it is more efficient to have one company acting as a monopoly to provide service to everyone, than to have several companies competing to provide the service. The common carrier provides the lines and other transmission facilities, provides the equipment for the customer to use in sending and receiving calls, administers the system and charges the customer for the service.

The telephone service as described here, does not include the radio-telephone or HF equipment which is frequently provided by the common carriers in the north. The radio-telephones have been installed to provide some service where there was none, and to do so as cheaply as possible. They are subject to the limitations described previously under HF radio, and in addition have been found unsatisfactory from the point of view of access and operation schedule. The telephone service referred to in this section, describes that typically provided to communities in the south - a high quality two-way voice communication, available in private homes.

It might be easiest to describe telephone service under three headings: terminal equipment, transmission facilities and types of service provided.

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Terminal equipment refers to the actual telephone set, consisting of a handpiece, which is used for speaking and for listening, and the base, which has (usually) a dial which allows the caller to direct his call to a specific person or location. Telephones may be either private or public. Private telephones are installed in an individual's home or place of business, and that individual is charged for the service on a monthly basis. Public phones are located in areas where they are easily reached by the general public, often in a phone booth. They can be used by anyone, and are paid for on a per call basis, by the person placing the call at the time the call is placed.

The transmission facilities for telephone service are most often land lines. Lines connect the telephone set to a central office in the community which contains switching equipment. Depending on the numbers that the caller has dialed, the switching equipment makes further connections to link the caller with the desired recipient - whether in the same community or at a distance. When the recipient is in the same community, all connections will be made by lines or wires. When the recipient is in another community, the connections may also be made by lines, or the signals may be transmitted by microwave or satellite facilities over part of the route. Both of the latter are very expensive facilities to install and both require direct or line-of-sight paths. This means that microwave facilities will require relay stations at regular intervals (e.g., every thirty miles or so) to maintain the line-of-sight path, and to boost the signal.

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The types of telephone service that can be provided can be described along several different dimensions. For example, one may have an individual or a party line, residence or business service, and may make local or long distance calls.

The terms individual and party lines refer to the number of people sharing one telephone line. With an individual line, only one individual (or household or business office) can make calls from that line. With a party line, two or four or six, or even more households can all make calls from the same line. They each have telephones in their houses, but all the telephones are connected to the same line from the central office. It is necessary to check before using the phone to make certain that it isn't already in use; privacy of conversation is somewhat curtailed, since anyone in any of the other houses can listen in on conversations.

Residence and business service refer to the use to which the telephone is put. If it is used for informal conversation, exchange of information etc.., and is installed in a private home, it is generally termed a residence service. If the phone is installed in a place of business and is used for business transactions, it is classified as a business service. The equipment and the facilities for the two types of service may be exactly the same, but the monthly rates charged for a business phone are higher than those for a residence phone. Higher rates are charged for business phones because generally, they are used more than residence phones, and are repaired more quickly when they malfunction.

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The terms local and long distance refer to calls placed either to other telephones in the same community (local) or to calls placed from one community to another (long distance). The boundaries of a community as a telephone company describes them, may differ from the boundaries usually recognized by community residents. So, for example, two small communities located next to one another may be considered one community for telephone purposes; or a small community that is a suburb of a larger one may be considered part of the larger community for telephone service. Usually, the monthly charge for the telephone allows one to make any number of local calls but an additional fee is charged for each long distance call. Long distance calls may be made either from one's home or business, or from a public pay phone.

There are also other variations on these types of service which can be arranged. For example, one may arrange a conference call in which people in different communities are connected together so that they may all talk and listen on the same line. This may be useful for business purposes since it allows a meeting to be held with people in different communities without their having to travel to one location. It can also be useful for informal conversation when members of a family or friends are living in different communities.

One may also arrange to have unlimited long distance calling at a set monthly rate, rather than being charged for each call. Two types of this service—Wide Area Telephone Service (WATS)—exist: INWATS and OUTWATS. In each case,

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the country is divided into a number of zones, each zone being so many miles from a community or city. With INWATS, one pays a monthly charge to be able to receive an unlimited number of long distance calls from specified zones without charge to the person calling. Some businesses find this useful to encourage customers to place orders with them. With OUTWATS, one pays a fixed monthly rate to be able to make an unlimited number of outgoing long distance calls to locations within specified zones. This service may be practical when one regularly makes a very high number of long distance calls to the same communities. For both of these services, the monthly charge increases as the distance and number of zones increase; they are used mainly by businesses.

Telephone companies can provide a wide variety of other types of services; however, these are the basic ones, and the ones most likely to be of interest for the purposes of this report. As we shall note, the provision of basic services has not yet been accomplished in many parts of the north, so we shall confine evaluation and discussion to these, rather than extending it to include some of the more sophisticated offerings.

Telephone service can appropriately be used to satisfy many communications requirements. It is frequently invaluable in emergency situations, can be used to announce meetings, discuss business, obtain information and to exchange information, and simply maintain contact. It is not appropriate for situations requiring the communication of visual information or those requiring contact with large numbers of people simultaneously.

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Potential: Telephone service can be, and in the south usually is, a high quality, highly reliable, readily accessible and fairly inexpensive means of two-way voice communication. It can be used for communication over very short to very long distances. By dialing specified numbers, or by obtaining an operator's assistance, one can reach most households and places of business in Canada and in many other countries as well. It usually permits privacy of conversation between two persons; however, where there are party lines, there is the possibility of privacy being somewhat reduced.

However, the fact of the matter is, that such a system is practically non-existent in the north. There are a few communities with local service and fewer with long distance or toll service. Moreover, to anticipate the coming of such a system in the near future would probably be somewhat optimistic.

Common carriers have been given the responsibility for the provision of telephone service; however, as independent companies, they also have a recognized right to earn a specified level of profit on their investment. The north is characterized by vast distances and small, widely separated communities; the far north is further blessed with perma-frost, severe weather conditions and treelessness. These contribute to make the installation of a telephone system expensive and time consuming. To establish telephone connections, it would be necessary to lay land lines or to use microwave or satellite facilities. The stringing of land lines from telephone poles meets with the difficulties of trying to install the poles

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and lines over hundreds of miles in adverse weather and often under permafrost conditions. Microwave requires relay towers every thirty miles or so, and meets with not only the above problems, but also the need for more expensive equipment. With satellites, the difficulties stem from the high costs of the facilities and technological limitations.

All of these factors point to high costs in an area where there are few inhabitants to use the system. Few inhabitants, and also the low proportion of businesses usually mean that the system will not bring in enough revenue to cover its installation, operation or maintenance costs. From a business point of view, the reluctance of the common carriers to show more initiative in the development of telephone service in the north is understandable. From the point of view of those in need of the service, their stance is frustrating.

It would appear that the most promising and effective way of providing telephone service in the north is through the use of satellite facilities. However, the day when satellites can economically be used to provide communication facilities to every small community in the north, is anywhere from five to twenty years away.

Training: The common carrier responsible for the provision of telephone service in any geographic area has the responsibility to install, operate and maintain the system. They have highly skilled people who can ensure that the quality of communication will meet certain requirements, and who have access to equipment that allows connection with many other locations.

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So, community residents have no involvement in these aspects of the system.

Those using telephones need only learn the procedures to be followed to set up a communication path with a specific person. This normally involves simply dialing and/or giving the information to a telephone company operator. With each telephone, a customer usually receives a directory, which not only has the names and phone numbers of all those in the community having telephones, but also has information on how to place calls to different locations, how to report emergencies, or to repair telephones in need of repair, etc..

Cost: The actual rates charged for various telephone services vary from one community to another, and also depend on which company is providing the service. Generally, there is a charge for installation which is paid just after the phone is connected, a service charge, which is paid each month for the operation of the phone and any maintenance which it might require, and long distance charges for any calls made outside the community.

Installation rates vary considerably; the Manitoba Telephone System and Saskatchewan Telecommunications charge $3.00, for example, while Bell Canada charges $11.00, and Alberta Government Telephones (and the British Columbia Telephone Co.) charge $10.00.

The charge for service in any one community will be the same amount each month, but that amount will vary depending on several factors. The two most important ones are, the number of telephones which a customer can

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contact with local calls and the type of service which the customer has. When a customer lives in a small community where there are, for example, under 2,000 telephones, he will pay a lower monthly service charge than a customer living in a city where a telephone allows him to make local calls to over two million people. Also, if a customer has an individual telephone line, he usually pays more than when he has to share the same line with a number of other customers.

The figures presented below, show the ranges in the basic monthly service charges for individual and multi-party lines, as charged by some of the telephone companies.

Monthly Basic Service Charge

Company	Type of Service: Individual	Type of Service: Multi-Party
Bell Canada	$4.00 - $7.55	$3.05 - $5.20
Alberta Gov't Tel.	$3.35 - $4.25	$4.25 - $5.25
Sask. Tel.	$2.40 - $4.15	$2.35 - $3.65
Manitoba Tel.	$2.40 - $3.90	$2.30 - $3.60
~~Edmonton Tel. Co.~~	~~$3.40 - $8.40~~	~~$2.10 - $2.25~~
CN Tel. (Nfld)	$4.60 - $5.00	$2.65 - $2.90
~~Maritime T. & T. Co.~~	~~$4.00 - $4.55~~	~~$3.00 - $3.35~~

These figures are as of August, 1974, and for residence service only. Costs for business services will be higher. In some cases, additional taxes would be also charged on these amounts.

The basic service charge is actually a rental fee, which allows the customer the use of the telephone equipment for one month to make unlimited

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local calls; should the equipment fail, repairs are made without any additional charges to the customer. The telephone equipment included in the rental and installed in the customer's home, ordinarily comprises one regular black phone. (When the service is discontinued, the phone must be returned to the telephone company.) If the customer wants additional or different equipment - e.g., an extension telephone in another room, or a more contemporary model phone in a different colour - he will have to pay additional fees.

The long distance charges vary, depending on the place being called, and the length of the conversation. Generally, the greater the distance between the two communities, and the longer the conversation, the higher the cost. Most telephone companies however, offer lower rates on long distance calls during certain hours. For example, late at night, the telephone lines are not used as much and calls placed then, usually cost less than if they were placed during the day. Also, if the telephone system in a community is such that customers can place their own calls by dialing the distant number themselves, then long distance calls placed in this manner, will be cheaper than if the customer had the telephone operator place the call.

For unlimited long distance calling, the rates are quite expensive. Wide Area Telephone Service (WATS), for example, can cost from $100 to over $500 per month for ten hours of long distance conversation, depending on the number of geographic zones included in the service.

Finally, it should be mentioned that it is not unusual for telephone companies to require a deposit from new customers. A deposit is a

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specified amount of money (e.g., $25 or $50) which the customer gives to the telephone company as a guarantee that he will pay his bills. It is usually returned to the customer after a month or so. If the customer doesn't pay his bills, the company uses the deposit to pay ~~its~~ their; if the situation continues, the company would probably cut off service to that person, and have this phone removed.

Other Information: Although it is unfortunate, there is little that community residents can do to obtain telephone service in their community. The telephone companies are constrained by the factors mentioned earlier, and are reluctant to invest heavily in an area with anticipated low revenues. Perhaps the best steps to take when a community wants a telephone system installed, would be to prepare a brief, defining their needs and to present the brief to both telephone company representatives and officials of various levels of government. The brief should attempt to be very specific, including statements as to whether local or long distance service, or both, are required, the number of people who would want telephones installed, the number of long distance calls which they expect to make per month, and some indication of how the costs of the service will be covered. It is likely that the further north the community's location, and the greater its distance from a large community, the lower the probability of the request being met within the near future.

There may, however, be interim measures which could be taken to satisfy some communications requirements.

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- The telephone company might consider installing one long distance circuit in a community instead of attempting to provide each home with telephones. It might be installed in a central and easily accessible location that would afford some privacy to the users. A record would have to be kept of who made calls, to where and when, so that those people could pay for their calls when the monthly bill became due.
- In circumstances where there is a frequent need to call government departments or agencies in distant communities, efforts might be made to try to persuade those departments or agencies to establish a service such as Zenith calls. Zenith service is an arrangement whereby a person can call long distance and the cost of the call is automatically transferred to the person being called. This may be useful in situations in which people needing information are prevented from obtaining it because of the high cost of long distance calls relative to their income.

Finally, residents of remote northern communities without telephone service, should give serious consideration to whether it would be better to lobby for extension of service into their area, or to wait until satellite facilities are widely available - making do in the meantime with something like HF radio. It is difficult to say which would be better, although in certain areas, it is doubtful whether even the most strenuous lobbying would have an effect. In these areas, e.g., those in the far north and remote

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from large centres where telephone facilities now exist, the effort might better be spent in developing an HF system to its full potential.

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TELETYPE

Description: Teletype is a type of communication system which allows two people located in different communities to exchange messages through the use of terminal equipment, having keyboards similar to those on typewriters. To send a message, one uses a dial on the terminal to dial a number for the intended recipient. One then types the message on the keyboard, and at the same time it is transmitted over lines to a terminal in the recipient's community. At that end, the message is usually automatically printed out on paper in the receiving terminal.

This is not a means of voice communication since one does not actually talk to the person on the other end. Instead, it is a means of communicating printed messages quickly between two distant points. It operates over what is called a switched network - as does a telephone system. This means simply that a caller sets up a path for his communication by dialing a specified number for the intended recipient. The dialing acts as a signal to automated switching equipment which selects and provides either a mechanical or an electrical path for the call. The process usually takes a few seconds.

Teletype service, like telephone service, is usually provided by common carriers. The two largest providers are Canadian National/Canadian Pacific Telecommunications, which offers Telex service, and the Trans-Canada Telephone System, which offers TWX service. Each has a separate net-

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work of customers. If, for example, someone has Telex service, he can exchange messages with all other Telex customers in Canada and the United States, but he cannot exchange messages with anyone having TWX service, and vice versa.

There are also a number of privately owned teletype systems. Large companies frequently install private teletype systems to link up each of their branch or field offices with the head office. Often, these systems allow communication only between those offices, and not with other Telex or TWX users - that is, they operate over private lines rather than over a switched network.

It should also be mentioned that the terminals used for message exchange as described above, can also be linked to a computer and can provide the means to run computer programs and do various types of calculations in a location remote from the computer.

Potential: Teletype service can provide a highly reliable and quick means of exchanging messages between distant communities. It can be used to send messages over thousands of miles, or to the room next door. However, its range is limited in the sense that one can use it to contact only other people in the same system (i.e., e.g., either Telex, or TWX, or a private line system). In southern Canada, its use is fairly widespread; many businesses, government offices and some large institutions have teletype facilities, but few residences do. In northern Canada, teletype is considerably less

extensive; most terminals are owned by businesses or religious organizations, are private networks and are not generally available for public use.

The systems can offer privacy in that the sender has control over which locations can receive his message. Other persons in the same system cannot gain access to his message unless he chooses to have it sent to them. If the terminals are located in places which are generally accessible to the public, those around the terminals may, of course, read the message as it is being sent or received; however, it is usually possible to make arrangements to avoid excessive limitations on privacy.

One important advantage of teletype systems is that they can receive messages at any time, whether attended or not. The received message is printed on paper in the terminal automatically and will be there when someone comes to check it or to send a message. This can be useful in communities that do not have the resources for a full time operator.

Another advantage is that most teletype machines produce a printed copy of both messages received and messages sent. When a lot of information, such as figures, lists of supplies, etc, is being transmitted, it is convenient to have a copy of the information as it was sent, rather than to have someone write it down while hearing it. There is less room for error in a teletype system, as both the sender and the recipient of the information have an exact copy of what was transmitted. In other cases, especially in business transactions, the printed copy can be filed and used later for reference, or as evidence of commitments made on certain dates, etc.

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A great disadvantage of teletype systems is that they rely on land lines or line-of-sight transmission facilities to provide connections between communities. The installation of the transmission facilities in the north is impeded by severe weather conditions, perma-frost and extremely high costs. This makes it unlikely that the north will see extensive development of teletype networks in the near future.

Another disadvantage of teletype systems is that, like most typewriters, the terminal keyboards consist of the roman alphabet. It can therefore be used for the transmission of messages in English, French and other languages using roman letters, but cannot be used for the transmission of messages in syllabics.

Among the most appropriate uses of teletype systems are the announcement of meetings, the conduct of band and council business and the distribution of information on weather conditions and plane and ship movements. This assumes of course, that all those requiring such contacts or information have access to a teletype network. It could also be used as a means of obtaining information from government agencies, and, in some cases, to establish contact between parents in communities and children away at school. It also has possibilities as a means of communication for emergency purposes, although this may be somewhat limited by the training required to use the terminal, by the fact that those from whom help is required may not belong to a teletype system, and by the delays that are inherent in the receipt of a message at an unattended terminal.

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Training: When teletype service is acquired as part of a switched exchange network (e.g., TWX or Telex), the company providing the service is responsible for installation and usually also for maintenance of the system. They will install the terminals where indicated by the customers, and will lay wires and make connections between the terminals and the rest of the network. They will usually also provide maintenance service on a regular or as required basis; this is sometimes included in the basic monthly charge for the service, or is covered under a separate maintenance contract. A relatively high level of skill is required for installation and maintenance of teletype systems, and companies providing switched exchange network service will usually insist on having their own trained technicians provide these services. It allows them to exercise control over who has access to their switching equipment and over the quality of service provided to customers.

Normally, companies providing this service will also provide training in the operation of the system and will distribute manuals describing the basic parts and method of operation of the terminals. The operation of the terminal itself is not really difficult, once a few basic procedures are learned and followed. There are specific steps which must be taken to set up a communication path; this usually involves turning the machine on, identifying the user (often by number), and dialing a code to indicate the recipient. The machine usually helps the user determine whether the correct procedure has been followed - either by indicating it is ready for the

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message, or by some form of non-activity, such as shutting itself off. The latter may be a bit frustrating, but at least it avoids the problem of having the user type in a message which is then not sent.

Once the machine has been made operational, one simply types out the message. The typing process is very similar to that used on a typewriter; however, usually all the letters are capitals (rather than having capitals and lower case letters), some of the numbers and punctuation marks will be located on different keys than on a typewriter, and there will be some additional keys on the teletypewriter. The procedure for correcting typing errors is also somewhat different. In general, anyone who can type will learn to use the terminal fairly quickly; those who can't, will learn the operating procedures as quickly, but will be much slower at sending messages.

When the message has been typed into the machine, one may either wait for an answer or turn it off. Terminals can be used in something similar to a conversation mode; a message is typed, then the recipient makes a response, which automatically types out on the terminal on which the original message was sent, and the exchange continues in this fashion. If there is no need for any or for an immediate response, the machine is simply turned off when the message is completed, or is used to send another message to a different location.

If the teletype system is to be used for message exchange, one or two days training with practice on operational equipment should be sufficient

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to learn to use it well. Those being trained will have to have learned to read and to write the language(s) used on the terminal; those with knowledge of only syllabics, or of spoken language, will probably not be able to use the system. (One should remember that this makes a teletype inaccessible to many older people). Again, being able to type is a further advantage: it can make the use of the system cheaper, since less time is spent transmitting a message, and it is also less frustrating for a recipient than if he must wait while a message is painfully eked out at the sender's end.

As mentioned earlier, teletypewriters can also be used to access remotely located computers. For this application, considerably more training is required, for the person operating the machine is actually running computer programs. This involves having at least a basic familiarity with computer programming methods, and a detailed familiarity with the specific program being run. Some computer programs are quite easy to run, requiring perhaps only the typing in of a few statements and some figures; others are considerably more complicated. To learn to operate a teletypewriter as a computer terminal would require anywhere from a week to several months training, depending on the previous level of education of the trainee, and the degree of sophistication of the programming being learned.

Computer applications of teletype systems and the associated required level of training, may not seem very relevant to the needs of many communities, and this may be particularly true for small communities. However, in other locations, residents would be well advised not to ignore the

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subject completely. For example, computers can be used for the following purposes:

- storing and sharing data on traditional cultures; for example, traditional tales could be stored in a computer at one location and people equipped with terminals in remote communities could have access to the information by typing in a word or number to indicate which tales they wanted printed.
- helping children learn; "programmed instruction" is a term used to indicate a method of learning in which the student uses a set of materials to teach himself, rather than have someone else teach him. Sometimes, the materials are in book form, but computer terminals are also often used. Usually the program gives the student some information and then asks him questions about it. The student types in his response, and the computer indicates whether or not he is correct.

The use of computers is, however, very expensive and there will be many communities that simply cannot afford the cost. However, in planning for the future of a community, it might be advisable to keep in mind the fact that many of the industries in the north - especially oil, gas, mining - use computers to perform various calculations required for their operation. If there are community residents trained in the use of tele-

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typewriters for computer programming, these industries might be persuaded to use local rather than imported skills, and would thereby improve the employment situation.

Cost: Because of the various applications to which teletype can be put, there is wide variety in the charges levied for the service. It will vary depending on whether the service is private (i.e., providing links only between offices of the same company, for example) or exchange (in which one may connect with anyone else subscribing to the teletype exchange service). It will also vary depending on whether the teletype is used for verbal communication or for a data application; the charges will also depend on which company supplies the service and equipment.

Here we will describe only the charges for the most common application - that of exchange service for verbal communication purposes. For other applications, and for more information on this application, one is referred to a communications consultant or to the various suppliers of teletype service.

The structure of the rates charged for teletype are similar to those charged for telephone service, in that, there is an installation charge, a monthly service charge and a charge for any long distance calls made. The two major Canadian suppliers of teletype service are the Trans-Canada Telephone System (TWX) and Canadian National/Canadian Pacific Telecommunications (Telex). The prices quoted here are for these two companies.

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The installation charge is a one-time charge, and covers the cost of installing the teletype machine in the customer's premises and connecting the terminal to the switching equipment which permits access to other teletype users. The installation fee for TWX is $30. and for Telex is $25 to $35., depending on the type of machine installed.

The basic monthly service charge is a rental fee which permits unlimited use of the service for local calls and includes any maintenance which may be required. It also varies somewhat with the type of machine used. A major distinction can be made between manual and automatic keyboard terminals. The manual is one on which the keyboard is used to prepare and to send the message at the same time, so that if one is a slow typist and/or a lot of errors are made, the message is sent slowly; and if it is a long distance message, it will be more costly. The automatic keyboard machine is one on which a message can be prepared "off line"; that is, the preparation and the sending of the message are two separate functions. The message is typed and corrected and a small punched paper tape is produced as a result. The paper tape is then fed into the machine and the message is sent at a constant and very fast rate. This type will result in lower long distance charges because the message is sent faster.

The basic monthly service charge for manual Telex is $50., and for automatic Telex is $85. TWX has two types of machines in each of these categories: The Basic one is intended for use of no more than 3 - 4 hours per day, while the Premium one is more durable and can withstand years of use at 10 - 12 hours per day or more. The monthly service charges for a

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manual keyboard terminal are $50.75 (Basic) and $66.00 (Premium), and for an automatic keyboard terminal are $101.50 and $137.05 for the Basic and Premium models, respectively.

Beyond the monthly service charge, there will also be monthly toll charges for any messages sent over a long distance. The price charged for a long distance message increases with the distance between the two points and the time spend sending the message. For example, a message from Ottawa to Montreal costs 16.2¢ per minute on TWX, and 10¢ per minute on Telex. A message sent from Ottawa to Vancouver costs 95¢ per minute on TWX, and 96¢ per minute on Telex.

The information on teletype costs from these two suppliers, and for this type of application, can be summarized as in the diagram below.

	Supplier Company	
Service Charges	Trans-Canada Telephone System (TWX)	Canadian National/ Canadian Pacific Telecommunications (Telex)
Installation (one-time)	$30.00	$25.00 - $35.00
Basic Service (monthly) Manual Send/Receive Automatic Send/Receive	$ 50.75 - $ 66.00 $101.50 - $137.05	$50.00 $85.00
Toll Charges (monthly) e.g. Ottawa-Montreal Ottawa-Vancouver	16.2¢ per minute 95¢ per minute	10¢ per minute 96¢ per minute

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One should be mindful that many other types of teletype systems can be arranged. It is possible, for example, to buy a terminal, rather than to pay a monthly rental fee - although the two companies above do not sell their equipment, other companies do. It is also possible to make separate arrangements for maintenance; if for example there are people in the community who have received a high level of training in teletype maintenance, it might be less expensive to have them provide the service rather than the supplier company. Computer applications usually call for a rather different configuration of rates, since it will also be necessary to pay for computer time. These are issues which should be discussed in specific detail with consultants - whether private or representing different supplier companies. (One does not invariably have to pay consultants fees for the services of these consultants representing supplier companies.)

Other Information: It may be sometime in the future before teletype systems appear on a widespread and inexpensive basis in the north. The high cost of establishing connection over great distances is one of the main factors retarding this development. However, the use of teletype systems - particularly for computer applications - is becoming increasingly common among people of all ages in the south, and probably will eventually be commonly used in the north as well. Because of this, it would be useful to have some community members become familiar with the operation and utility of such systems, since it would provide a means for the gradual introduction of this technology into nothern society. As well, it can provide a source of income as industries with computerized operations become more prevalent in the north.

Radio

Description: Radio is a general term for a type of communication system in which an audio signal is broadcast from a central transmitter by means of radio waves, and can be picked up by any of various types of radio receivers within the transmitter's range. This type of communication is sometimes called broadcast radio, and is quite different from the HF radio systems described in a previous section. Unlike HF radio, broadcast radio:

1) has a fairly limited range, and is usually intended to be received in the same community in which the transmitter is located; and

2) is ordinarily a one-way form of communication. The signal is broadcast from the transmitter to the radio receivers in the area; the recipients of the signal can not usually reply to, or initiate communication.

Radio is ordinarily a means of intra-community communication because of its rather limited range. However, there is a special way in which radio can become a means of inter-community communication in the north. This is through the installation of low power transmitters in many communities, and the exchange of taped radio programs among those communities. Often, community residents would like some form of radio, yet they may not have the time nor the money resources to operate and to provide the necessary programming required for a regularly operating radio station. The possibility of exchanging programs with other communities can make it easier for a small community to begin radio operation.

The exchange of radio programs can, however, serve a still more important function. As was noted in the Requirements section, there have been repeated demands by people of the north for

some means of communication to reduce the sense of isolation among communities, and to encourage the sharing of ideas, problems, and various aspects of cultures. Particularly in the areas of culture and education was there expressed a need for some way in which there could be more northern control, more input reflecting a northern orientation. The introduction of community radio stations with the inter-community exchange of recorded programs in one way of beginning to fulfill these demands, and it is in this application that radio is described here.

Radio relies on the radio frequency spectrum for the distribution of its signal. Basically, an audio signal is converted to an electrical signal and input to a transmitter which determines the strength of the signal transmitted. An electrical signal of a specific strength or output power potential is then sent through coaxial cables to an antenna, where it is changed into radio wave form and radiated. It makes use of either the medium frequency (MF) or the very high frequency (VHF) bands of the radio frequency spectrum. These terms refer to the number of radio waves transmitted per second, and each band of frequencies has different characteristics affecting transmission.

A distinction can be made between AM (amplitude modulation) and FM (frequency modulation) radio. These terms refer to different methods of transforming sounds into electrical signals and eventually into radio waves. In AM radio, the transformation is based on the shape of the sound wave produced by the original signal, whereas in FM radio, the transformation is linked to the

number of sound waves produced per second by the original signal. What matters more for our purposes, however, is the fact that the two types of radio make use of different bands of the radio frequency spectrum, with AM relying on the MF range, and FM using the VHF range. This difference means that AM radio will have a larger coverage area than FM, since the latter requires a line-of-sight transmission path, and is more likely to be blocked by obstacles such as hills, buildings, etc. However, because FM radio is not subject to interference from electrical sources, it provides better quality transmission than does AM radio.

Because they operate via different bands of frequencies, FM and AM radio signals usually require different types of radio receivers. An AM radio receiver will not be able to pick up an FM signal, and vice versa. It is not uncommon, however, for radio receivers to incorporate both types of receiving equipment, so that by moving a switch, the radio may be used as either an AM, or as an FM receiver.

For the purposes of this report, the above are the main distinctions between AM and FM radio. On many other dimensions they are alike, and with a few exceptions, what is said concerning radio in the remainder of this section may be applied equally to one or the other. The exceptions will be noted.

In general terms, a complete radio system consists of the following segments:

- some form of input device, such as microphones, etc., to receive the sounds which are to be broadcast

- an amplifier, which permits control over the loudness of the signal to be broadcast
- a transmitter, which controls the power or the strength of the signal broadcast
- an antenna, which translates the electrical signal into radio waves and radiates them
- numerous radio receivers within the range of the transmitter, which receive the radio waves and translate them back into the form of sounds.

Input devices can be of various sorts; the particular device(s) selected will depend on the kind of signal(s) to be broadcast. If the signal consists of voice input, a microphone will be required. This, for example, would be required to permit a broadcaster to transmit a message or an announcement, or to allow several people to hold a discussion which they wanted broadcast to the community. Microphones are also used by singers and musicians doing radio programs. It is important to be aware of the fact that there are various classifications of microphones: some are more rugged than others; some are better for music or for voice; some are better for outdoor sue than others. In adddition, microphones can be selected for sensitivity and range--some will pick up a sound coming from any direction within so many feet, while others are more sensitive in one direction than in another. Because of these factors, it is important to select microphones that are best for the particular application to which they will be put.

Frequently, music which is broadcast over radio stations originates in recorded sources rather than in live studio performances. The two most common sources of recorded music are records or discs,

and audio tapes. When recorded sources are to be used, they require different sorts of input devices: records require a turntable, and tapes require tape decks. It should be noted that audio tapes may be in either "open reel" or "cassette" form. The first refers to reels of tape that can be manually or automatically wound or unwould from the reels, while the second refers to tape which is enclosed in small plastic cases and cannot be manually wound or unwound. Each type requires different machines for both recording and playback. Audio tapes of either variety are also used for recording voices--for example, a meeting or an interview.

The three most common types of input devices, then, are microphones, turntables, and tape decks. In planning the set up of a radio station, it is very important to consider which types of signals are to be broadcast, and the sources of those signals. It is also important to assign priority to each type of signal and source--that is, to decide for example, if it is more important to be able to transmit live voice first, or if more importance is attached to broadcasting recorded music. These factors will determine what equipment is to be purchased, and which should be acquired first.

An amplifier basically allows the broadcaster to control the loudness of the signal he is broadcasting. When the signal is too low, background noise in the studio may make it difficult for listeners to understand what was intended to be transmitted. When the signal is too high, listeners usually hear a distorted sound. There is an optimum level, and an amplifier allows the

broadcaster to transmit within a range around this level.

Often, however, amplifiers are contained in units which perform more complex functions. Such units are usually called audio mixers or consoles. A mixer does what one would expect it to--it mixes audio signals from various sources. For example, if a broadcaster is talking and playing records during a program, a mixer would accept both signals, and allow for the loudness of each to be corrected before sending it out over the air. This function is particularly important when using recorded sources, since different records or tapes may have been recorded at different levels of loudness. A mixer is essential when two sources are to be broadcast simultaneously--for example, when a message is to be broadcast with music playing quietly in the background. Any of the input devices mentioned above--microphones, turntables, or tape decks--can be connected to an audio mixer.

The term console is often used for mixers which have additional capabilities, such as allowing one to monitor, or hear in the studio what is beign broadcast; or allowing one to cue. Cueing is the process of playing a record or tape without broadcasting the signal; it is particularly useful when only part of a tape or record is to be transmitted, and the broadcaster wants to find the particular spot where that part begins. Once found, he has only to switch a button when he is ready to transmit it.

Transmitters and antennas are sued in the actual distribution or broadcasting of the signal. As noted earlier, the transmitter

determines the power at which the signal is sent, and the antenna transforms the electrical signals from the transmitter and radiates them in the form of radio waves. These two together are the important determinants in the extensiveness of the range of any radio station. Although the range of a station is often limited to the surrounding community, it can be increased by varying the output power of the transmitter, and the height of the antenna. Generally, as the output power of the transmitter, and the height of the antenna increase, the range of the station also increases.

Behind all of the above equipment there must be a power source. Almost all of this equipment is constructed so as to operate off a commercial source of AC electrical power. Where such a source is not available, a generator must be obtained to supply the required power.

Radio receivers are small, compact units which contain an antenna which receives the broadcast radio waves and transforms them back into the form of sounds. Unlike HF receivers, broadcast radio receivers are constructed so that they may pick up signals over a range of frequencies, rather than on a few specific frequencies. AM radios are capable of picking up any radio signals in the 535 to 1605 kilohertz range, while FM radios can receive radio signals in the range between 88 and 108 megahertz (assuming of course that there are stations in the area broadcasting in these ranges). A particular frequency can be selected by moving a dial across the receiver's range. Since each radio station must always

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transmit at one particular frequency, one selects a specific station by selecting a specific frequency. Radio receivers may either require a commercial source of AC power, or be capable of operating off batteries.

A broadcast radio system is a one-to-many form of communication. The signal is transmitted form one station, but it may be received by an unlimited number of radio receivers within its range. Again, the communication is usually one-way.

There is, however, the potential of making the system into a two-way form of communication by connecting it to the telephone system in the community. This usually involves the leasing of a special line form the telephone company; this line is linked not only with other telephones in the community, but also with the stations's broadcast lines. Conversations between people calling the station, and the broadcaster, can then be broadcast to all radio receivers in the community. This is the basis of the "phone-in" radio program where people call the station to be able to share with the community their opinions, needs, jokes, recipes, etc. Most radio broadcasting, however is one-way; and the above phone-in program would not be practical on an inter-community basis because of the high cost of long distance calling.

Within one community, radio can be an appropriate alternative for almost any of the types of use mentioned in the Requirements section. It is an excellent medium for making announcements, for giving weather reports and news of plane or ship movements. It

can also serve as a focus for cultural exchange and education within the community, as well as a means of spreading news about events or people.

It can also satisfy certain types of requirements for communication between communities. To do so, each community must have a small radio station equipped to accept tapes and to transmit them to the community. Residents within each community prepare programs, tape record them, broadcast them to their own community, and then send them on to another community by mail. This method will, of course, be a fairly slow means of communication; however, in some cases, speed is less important than the actual content of the message and the fact that it can be exchanged with other communities.

Used in this way, radio is <u>not</u> an appropriate alternative for inter-community requirements relating to emergencies, weather reports, or plane and ship movements. It can however be a valuable alternative in satisfying other requirements.

For example, if community leaders would like to share with residents of a number of communities the issues that were discussed at certain meetings, they can simply bring a small portable tape recorder and microphone to the meeting, record the discussion, and then take the tape to the radio station for broadcasting. Later, it may be sent to another community. Similarly, families could make tapes in their homes, giving news of family members, friends, etc. These tapes could likewise be sent on to communities for interested friends or other family members to hear.

An educational program could also be arranged, either for children or for adults. It might consist of a series of tapes made at a central school on for example, language, mathematics, or nutrition. Copies of the tapes could be sent in a batch, or on a regular basis to communities, where the radio station could broadcast them at specific times each day or week. Where required, additional materials, such as books, exercises, etc., could also be sent by mail.

A similar arrangement would also allow for the exchange and preservation of cultural information. Portable tape recorders can be used to record folk tales and myths as recounted by older members of the community, as well as to record instructions in crafts, and items of oral history. By taping this information, the community is ensuring that it will not be lost as time passes, and by exchanging it with other communities for broadcast, the community is increasing awareness of aspects of its culture among a wider range of people.

One will note that the above applications frequently require portable equipment. Many tape recorders are intended to be used on this basis and are compact, light weight and battery operated. The tapes recorded with portable machines can then be taken to a radio station and used on the tape recorder there for broadcasting to the general community. However, if this is the intended use, it is important to ensure that there is compatibility between the portable and the stationary equipment. If the tape recorder in the radio station is of the open reel variety, as it often is, it

cannot be used for broadcasting programs made on cassette tape recorders without being first transferred to an open reel format. Open reel tape recorders accept only open reel tapes.

Potential: Broadcast radio can form an excellent means of communication when used for its intended purpose--that is, the transmission of a one-way audio message to multiple receivers within a limited range. That range, as indicated above, will vary with the transmitter power and antenna height. It can also be affected by specific geographic features in the area. Depending on these variables, the range may be as little as a mile or two, up to perhaps a hundred miles under very favourable conditions.

Within its range, the station should be able to transmit a reliably clear signal. However, to the extent that there are nearby electrical motors, AM stations will be faced with a deterioriating signal due to interferences from these sources. In extreme cases, the interference noise caused by motors can almost completely obliterate the signal for periods of time. FM stations do not have this limitation.

When used for the inter-community applications described above, the clarity of the signal is in part dependent on the clarity of the tape. If the tape was made outdoors with a microphone which picked up a lot of wind noises, for example, it may be close to impossible to hear the program when it is broadcast. Similarly, making a tape in a noisy room will also cause a poor quality product. Before any tape is offered for broadcast, it should be

played back and listened to with the intention of determining whether background noise is excessive. Better still, care should be taken at the time of recording to reduce irrelevant sounds to a minimum in the surrounding environment.

In selecting portable equipment, one must often make a trade-off between portability and the quality of the resulting product. Small tape recorders are very convenient in that they are light, can be easily tucked into a corner, or carried over long distances. However, the quality of the sound recorded is often unacceptable, and the machines themselves tend to be less rugged than larger ones. The larger tape recorders are frequently heavy enough and big enough to warrant questioning the term "portable"; however, they will usually last longer, and will produce a recording which is very true to the original sound.

Much of the potential of a radio station is dependent on the abilities of the people operating it. With tape recorders and microphones, it is important that the users test the equipment under varying circumstances so that they become familiar with its characteristics and can make use of this knowledge to produce the best possible program. This is true also of other input devices and amplifiers. As experience with the equipment grows, the quality of the product ususally increases.

Training: It is generally true that the installation and maintenance of a radio station require highly skilled technical expertise, while the operation and administration of the station can be learned over time by those with very little training or education.

The installation requires the assistance of an electrician trained in radio systems, since it involves the connection of various electrical devices to the transmitter. Within the studio, the various input devices must be connected to the amplifier or mixer, and an output line must lead from the mixer to the transmitter and from there to the antenna. If a phone patch is part of the equipment, telephone company technicians will also have to be consulted.

Usually, those acquiring a radio station arrange for skilled outside help in installation. The company supplying the equipment may undertake the task, or a communications consultant may be able to recommend another group. This importing of expertise really is essential to the proper set up of a radio station. However, it is advisable for community members to observe the procedure for the following reasons:

- so that they may learn the functions of the various parts;
- so that they may know about any peculiarities in the way in which their system is wired.

Also, it is not unusual for the community residents to be responsible for parts of the antenna erection procedure, and especially for carpentry work required on the inside of the studio.

Maintenance of radio stations may be segregated into two levels: that requiring considerable technical expertise, and that readily learned with no prior training. The former will require outside help, or perhaps the assistance of a community member who has received the necessary specialized training. Such help is

required for major an thorough preventative maintenance functions, which might involve an annual check of every part of the system, and is required in cases where the system malfunctions and cannot readily be corrected by the operator.

There are other maintenance functions which can be carried out by the operator, or another person involved in the station. For example, this would include cleaning the heads of tape recorders, checking and replacing fuses and batteries. Some training is necessary to simply show the person what is to be done. One demonstration, and the use of a manual supplied by the equipment company may often be sufficient. Generally, the more complex the station equipment, the more complex and the more frequent are the maintenance tasks associated with the equipment.

To ensure continued and efficient operation of the system, it is important that community residents be able to assume a considerable share of the responsibility for its maintenance. While initially this share may be at a mimimal level, it would be beneficial for community residents to undertake to acquire the requisite skills to assume a larger share. This may involve careful observation and close questioning of the trained maintenance person who services the system, or the following of a formal course in technical training. Whichever, the investment will be found well worth the while when it prevents outages of broadcasting service.

The <u>operation</u> of a radio station does require a certain amount of training, but it is a function which should definately be undertaken by community residents if the system is to reflect

their requirements. Most of the training, however, does not presuppose any special skills, and can be fairly readily learned by many people. In arranging for the necessary training, community residents should insist on:

- "hands-on" experience with actual equipment, preferably the system on which the trainees will be broadcasting;
- a continuing source of assistance whose involvement in the operation gradually decreases and is withdrawn.

Because on-air broadcasting causes nervousness in many people, it is important that the trainer be heavily involved in the station operation at first. However, as the broadcaster trainees gradually acquire skill and confidence, the trainer should gradually withdraw from actual operating functions and serve in an advisory role as required.

The operation functions may be considered as having two aspects: equipment operation and programming. At times both of these will be performed by the same person, while at other times many people may be involved in one or both aspects. We consider them separately here for the sake of convenience.

Equipment operation involves turning on the main source of power for the station, connecting and operating input devices to the amplifier, adjusting the various controls associated with the amplifier, and ascertaining that the signal produced is fed out to the transmitter. These functions are in general terms; the specific tasks will depend on the complexity of the equipment, and the nature of the program (e.g., live or recorded, disc or tape) being broadcast.

These tasks are not difficult to learn, yet they take a little time and experience, since they involve actions and ways of thinking to which many of us are not accustomed. For example, new operators frequently take a little time to accept the fact that within the studio, signals are transmitted from one piece of equipment to another electronically, rather than through the air. A record can be played and broadcast without being heard in the studio, and when a monitor is used to bring the sound into the studio, the controls for the loudness of the monitor will be separate from those for the broadcast signal. These are instances of things which are not really difficult, but rather simply unfamiliar. Most people could probably learn the basic operations in about two days, and with two weeks practice could become fairly proficient in their execution.

The programming aspect is a much more important function. It matters little how well an operator can coordinate input devices and control sound levels if the content of the program is of poor quality. One common mistake made by those new to radio is to put greater emphasis on the equipment than on the programming. New and unfamiliar equipment, especially if complex, is like an attractive toy--it seems to challenge one to learn how to play with it. However, when the manipulation of machines becomes an end in itself, it is doubtful if community requirements will be satisfied.

Another tendency of new broadcasters is to copy the style and format of professional broadcasters in their programming. This may or may not be a mistake. It is important to learn to use the

equipment skillfully, yet one should question whether their community radio station is intended to serve the same purposes as professional radio stations in large centres. If the station was to have been used mainly for information dissemination, the community's goals will not be served by a station broadcasting a menu of disc-jockey chatter and recorded music. When it is intended that as many community residents as possible be encouraged to use the station, this goal may be defeated if residents are intimidated by a professional, slick-sounding station. An effort must be made to develop a station which demonstrates proper and skillful use of the equipment, and yet maintains an image which is reflective of the community.

Programming involves considerable forethought both in determining the kinds of content required, and in the actual putting together of a specific program. The former is usually the responsibility of a citizen's committee and/or a station administrator, while the latter can fall into the hands of almost anyone in the community.

In developing a program, the specific operations will to a certain extent be dictated by the nature of the content. There are, however, a few general considerations which might be helpful for those new to the task:

- It is important to strive for clarity of content. This applies not only to the technical considerations mentioned earlier which can contribute to clarity of signal, but also to the content itself. Those hearing the tape may be unfamiliar with certain people, events, sounds, terms, and one should carefully consider whether they warrant definition or explanation on the tape.

- The length of the final product should be kept in mind. If one is producing a series of tapes which are to be broadcast at specific times, it may be preferable to have all of the tapes of equal duration--e.g., a half-hour.

- One should decide whether or not a tape should be edited. Editing as a general term refers to the modification of a tape in some way. For example, one might want to re-arrange the order in which specific items appear on the tape; this can be accomplished either by physically cutting and splicing the tape, or by re-recording it in the desired order on another tape.

- One should be careful about recording something against the wishes of those whose voices are recorded. If a tape is to be broadcast, one should obtain permission to do so from those heard on the tape.

The administration of a radio station is usually a fairly involved and demanding responsibility, but is also one which can and should be assumed by community residents. Only when it is can the community be assured that the station will reflect its requirements.

There are a number of ways in which administrative tasks can be handled: all those associated with the station may share the tasks; one person may be appointed an administrator or manager, or a citizen's committee may be set up to fill the role. These are examples of possibilities; the community should decide which structure they feel would serve their interests best.

Whether the role is filled by one person or by many, it will involve the execution of the following types of duties:

- training

- planning programming schedule

-arranging for maintenance

-other varied tasks: ordering supplies, applying for licence renewal, etc.

The training function includes the training of those people using the studio on a regular basis, as well as of those needing only some assistance in preparing a program for broadcast. This can range from developing a full-time on-the-job training program to showing someone how to operate a tape recorder or to splice tape. For these tasks, the administrator or manager may well find it advisable to prepare a manual explaining certain operations. Such a manual could be geared to the particular configuration of equipment in that studio, and to the types of needs that seem to occur most frequently.

Planning a program schedule is one of the most important tasks in the administration of a radio station. It involves decisions as to how structured the schedule will be, the number of hours to be broadcast per day, and what programs are to be scheduled for what time periods. In making these decisions, consideration must be given to the schedules of those who will be listening to the programs, so as to allow for a maximum audience.

Decisions must be made as to what content is to be broadcast, and what sources will be used for this content. If one can draw on resources within the community, it is necessary to arrange for specific people to do specific programs. When recorded sources from outside the community are to be used, the administrator must arrange for delivery of the recorded material, and make sure that

it is available when required. Similarly, he must coordinate the sending of tapes from his community to others. The administrator should also be continually evaluating the programming performance of the station--as a whole, and as produced by specific persons.

Maintenance tasks must also be scheduled and supervised. This involves assigning responsibility for the minor day-to-day checks which must be made, as well as arranging for special assistance for major equipment overhauls. The administrator may also want to assume responsibility for training on maintenance or arranging such training so that community residents can take on a greater share of this task.

Another administrative responsibility is the fulfilling of licence obligations. Before it can legally begin operations, a broadcast radio station must be licensed by the federal government; the Canadian Radio-Television Commission (CRTC) is the actual licensing authority. Essentially, licensing is necessary because the radio station is making use of the radio frequency spectrum.

The radio frequency spectrum has a limited number of channels or frequencies, and some are more appropriately used for certain applications than for others. To ensure most efficient use of the spectrum, the government must approve the number of users and the way in which they use it. This approval involves a number of aspects:

- The equipment comprising the system must be of an acceptable level of quality. It is generally necessary for the specific models to be approved by the Department of Communications.

- The station must select an operating frequency which is clear--that is, a frequency which is not being used by any other station near enough for the two to interfere with one another. There are very specific criteria which must be met to accomplish this.

- The station must be designed to operate at a specific level of output power that is sufficient to cover its intended range, but not so great as to interfere with other stations.

The simple completion of these steps does not guarantee that a licence will be granted. Because of the limited nature of the radio frequency spectrum, the radio waves have been declared public property--that is, they belong to everyone, and a few are granted the privilege of using them for a specific period of time (i.e., are licenses) on behalf of the public. The programming that they produce must then be in the public interest. When applying for a licence, a prospective broadcaster will be required to describe the nature of the programming that will be broadcast, and to explain how it satisfies community requirements and reflects community interests.

Once a licence has been granted, the broadcaster is required to keep recordings of his programming for specified periods of time, and to keep other records which can be made available to the CRTC when required. A licence is granted only for a specified period of time (e.g., two or three years), and at the end of that period, the broadcaster must apply for a licence renewal. For more information on the requirements, and on the specific procedure to be followed for both applications and renewals, one should write to the following address:

The Secretary
Candaian Radio-Television Commission
100 Metcalfe Street
OTTAWA, ONTARIO, K1A 0C8

Finally, other administrative responsibilities include the ordering of supplies, such as replacement parts, records, and blank tapes. The administrator must be able to predict the rate of use so that supplies will be available when required.

Costs: The cost of a radio station will vary with the equipment selected, the resources available within the community, and the operational structure of the station. Depending on these factors, the costs may range anywhere from $2500. to over ten times this amount.

Communities with limited funds will probably find it advisable to start operations with a bare minimum of equipment, and add to it as their funds and requirements grow. A study on community radio equipment has been completed by Ryerson Applied Research Limited for the Canadian Broadcasting Corporation. In it, the following phases of development were suggested:

Phase I - 1 audio mixer (or simple console)
1 portable tape cassette player
1 microphone
1 monitor headphone
1 telephone input
1 logger recorder (if necessary)
1 line voltage regulator (if necessary)

Phase II - all components in Phase I, plus the following:
2 phone turntables
1 console with cue and monitor facilities

Phase III - all components in Phase I&II, plus the following:
1 cassette tape deck
1 open reel tape recorder or deck

Phase IV - all components in Phase I,II&III, plus the following:
1 submixer (for multiple microphones)
1 multi-line telephone
1 remote telephone line driver (remote audio work)
multiple microphones

Phase V - Standard broadcast studio facilities. This stage of development is outside the scope of this report and is included as a reference level only. (Ryerson, 1974)

One will note that Phase I, since it includes a portable tape cassette player, a microphone, and a telephone input, gives the broadcaster the potential to produce live programs (e.g., weather reports, interviews), to have a "phone-in" program in which community residents participate via the telephone system, or to broadcast tape recorded material such as music, recorded messages or stories, etc. This is a considerable potential, given that it actually requires very little equipment.

The Ryerson report is one that should be consulted by any community intending to acquire a radio station. The purpose of the report was to evaluate audio components that might be suitable for use in small community radio stations. Although it tends to be a bit technical in some sections, it does provide a considerable amount of information on a variety of components. The criteria for evaluation include simplicity of design, durability, maintenance requirements, compactness, economy, etc. Prices of specific models are given, and the names and addresses of supplier companies are also included. The study (entitled "Evaluation of Audio Components for Community Radio") was initiated by the Canadian Broadcasting Corporation's Office of Community Radio, and one should be able to obtain a copy by writing to:

CBC Office of Community Radio
P.O. Box 500, Station 'A'
TORONTO, ONTARIO, M5W 1E6
Attention: Alan Martin

The costs for the acquisition and operation of a radio station can be considered under the three general headings of equipment, salaries, and operating costs. Each of these may be further specified as follows:

Equipment	Salaries	Operating Costs
Studio equipment	Installation	Building rent, heat, light
Transmitter	Training	Electricity, gas for generator
Antenna	Operation and administration	Telephone line(s)
Materials for building renovation	Maintenance	Supplies
Replacement parts	Consultation	
Supplementary portable equipment	Transportation	

The following prices are intended to give an idea of the range of costs involved for various items. It is not really possible to cite specific costs here because they are determined to a great extent by community requirements. The figures presented below usually represent ranges for fairly inexpensive, yet durable types of equipment. They do not, of course include freight charges nor any taxes which may be applicable.

Studio equipment refers to input devices such as microphones, tape recorders and turntables, and amplifier-mixer units. One might expect to pay the following prices for such components:

Microphones	$20.-$100.
Headphones	$10.-$25.
Turntables	$250.-$500.
Plus tonearms & cartridges	$50.-$200.
Tape recorders (open reel)	$300.-$1400.
Tape cassettes	$100.-$150.
Mixers	$1000.-$1500.

Consideration should be given to the quantities of each item to be purchased, since discounts are sometimes given on large orders. Although one microphone may suffice at the beginning of

operations, it will soon be found that others are required to cover larger groups of people, or to operate under different situations. Similarly, it is difficult to program with only one tape recorder or cassette. Having two recorders allows one to edit programs, to preview or cue programs, and to schedule more easily. If it is fairly certain that two or more of an item will be required in fairly short order, it might be more economical to acquire all at the same time.

Transmitter and antenna costs vary with the type selected, and with the output power of the transmitter. One should probably expect to pay $3000.-$4000. for FM, and somewhat less for AM equipment. There is one way in which these costs might possibly be avoided in some communities. This applies to communities located near a CBC low power relay transmitter, and is discussed at greater length under "Other Information".

Some replacement parts should be kept on hand to ensure continued operation in the face of minor malfunctions, or equipment senility. For example, it would be advisable to have extra microphones, headphones, and cassette recorders on hand.

Supplementary portable equipment refers to tape recorders and microphones which are acquired for the use of community members in preparing programs. These should be relatively light, yet rugged and dependable enough to produce an acceptable quality tape. An auxiliary microphone is often used instead of the microphone included in the recorder to improve the sound quality, so

it is advisable to have microphones for this purpose as well as for in-studio use.

The costs of salaries to the community will depend on which skills can be drawn from the community, and which must be imported, and on which tasks are accomplished through paid work and which through volunteer assistance.

It is highly likely that outside help will be required in the installation phase, and the cost of such assistance will probably vary with the skill of the technicians and with the complexity of the undertaking. Communities are advised to contact qualified companies or individuals for estimates on their charges.

Training may well cost the community little or nothing. Community residents should insist on having a training session included in the charges of the supplier and/or installation company. Other possibilities include requesting assistance from nearby communities having radio stations, or from the nearest CBC station. It is highly probable that either of these sources would agree to have trainees come to their stations and learn how to operate and program. In other cases--especially in training for more complex aspects of maintenance, it may be necessary to travel to a southern community college or vocational training centre. Once certain skills have been acquired by some community members, they can be passed on to others--usually on an informal and non-paying basis.

Operation and administration functions may be performed by either volunteer or paid personnel. The former is of course the most inexpensive route for the community, and may be followed especially in the initial phases of operation. There is a possibility, however, that volunteers will eventually experience a drop in enthusiasm, and as a result, the regularity and quality if their work may be reduced. This is especially serious when volunteers are required and counted on to do regularly scheduled programs.

When one person is appointed the administrator or manager, it is highly desirable that he be paid for this function; however, other structures of both administration and operation may be accomplished with a variety of combinations of paid and volunteer work. For example, a full time operatory may be hired and paid; those producing programs may contribute them freely, or may be paid on a per program basis; or a person may contribute operating time and be paid for doing programs, etc. Each community will have to decide which arrangement best suits its purposes and resources. Where employees are paid, one might expect a full-time operator to receive $500.-$600. per year, and a full time administrator $8000.-$9000.

Maintenance costs refer to those charges levied by technicians for more or less major servicing, rather than to the daily tasks which can be done by the operator or administrator. The community should contact a qualified company or individual to determine the charges for this service--these charges should be lower to

the extent that maintenance can be undertaken by the regular staff.

Consultation fees may or may not be applicable to a particular community. Often, consultation services can be obtained free of charge from supplier companies. However, one should be aware of the fact that supplier companies will push their own products--often with little regard for the particular requirements or funding situation of the community. It may be more beneficial in the long run to turn to an independent communication consultant for advice--although that advice may cost $100. per day.

Another (free) source of assistance is the CBC's Office of Community Radio--the address was given above. This office has been developed to help communities in the establishment of small radio stations; they produce and distribute a variety of information on the subject, and are usually very receptive to requests for advice.

Transportation costs should be included in an estimate of station expenses because funds will be required to cover travelling and maintenance for trainees and possibly trainers, for installation crews and consultants, and for those responsible for licence application and renewal. Each community should try to estimate the total of such costs--both initially and annually--based on the number of people, frequency and duration of trips, and distance travelled.

Operating costs refer to recurring expenses associated with the broadcasting undertaking. The community will have greater control over some of these costs than over others. For example, the charges for building rental may be kept to a minimum if an appropriate building can be made available at little or no rent. This will depend on the resources existing within the community. There will, however, be less control over the charges for heat, light and electricity if these are supplied by a commercial source of power. Where thee use of a generator is necessary, the cost of gas can become an extremely important factor, given the already high cost per gallon in the north. The community should contact a station operating under such circumstances to get an estimate of the charges they might expect from this source.

If the radio station is to be equipped to produce "phone-in" programs, it will be necessary to arrange for connection to the community telephone system. The Ryerson report mentioned previously indicates that Bell Canada leases a conference line for $15. monthly which could be used for this purpose. Depending on the studio-transmitter proximity, it may also be necessary to lease telephone lines to link the studio to the transmitter. The charges for such connections will vary considerably with the locality and the service provided, and it will be necessary to contact the appropriate telephone company for specific information.

Supplies for the station include not only such essentials as stationery, but also recording supplies such as blank and

recorded tapes and cassettes, and records. The cost of blank tapes and cassettes depends for the most part on the length of the tape; those recording a half-hour of information would cost about $3. An attempt should be made to determine the number required per year, allowing for exchange between communities, and for the re-recording over old information. (It should also be noted that most tapes have multiple recording tracks.)

Records retail for $5.-$6., but can be obtained at considerable savings in bulk orders from record companies. In fact, bulk orders of tapes and cassettes will also result in savings. The stationery needs mentioned above could probable be obtained for about $50. per year.

One will note that all of the above charges are associated with the broadcasting end of a radio station. On the receiving end, there must be a radio set capable of picking up the broadcast signals. Radios range in price anywhere from $5. to $500., and many people in the community may already have sets. They may be AM, or FM, or may have the capability of operating on either band. They may operate off a commercial source of AC power, or may be battery operated. Generally speaking, FM radios cost more than AM (which one is chosen should depend on which type of station broadcasts in the area) and more expensive radios last longer and provide better quality sound than do the cheaper ones.

The above can be expected to include the major sources of expenditure for a broadcast radio station, although there may be additional charges which will be incurred in specific localities.

While radio is a considerably less expensive broadcasting undertaking than television, it does involve a lot of money, and perhaps more important, a considerable investment in time and effort over a long period. These are points which should be kept in mind when deciding if a broadcast radio station is the appropriate alternative for any community, how long the station will be on the air each day, what content will be broadcast, and who will be responsible for the production of that content.

Other Information: There are three types of information relevant to the acquisition and operation of a broadcast radio undertaking:

i) sources of assistance and information

ii) possible use of existing low power relay transmitters

iii) non-broadcast use of audio recording

(i) Any community deciding to acquire and operate their own radio station is well advised to take advantage of existing sources of assistance and information. Probably chief among these sources is the Canadian Broadcasting Corporation's Office of Community Radio. This is an office of the CBC that was set up with the explicit intention of helping communities establish their own small radio stations. They have various kinds of expertise available, and are very cooperative in sharing their knowledge resources with community members. They could be contacted for advice, or for any of a number of publications which they distribute.

One of these publications is called the Program Source Directory, and will be useful in obtaining programming material for

a new community radio station. It consists of a list of Canadian sources of taped programs suitable for community radio--it gives a short description of each source, the programs they have available, and information on how to obtain the programs (CBC, 1973). Another publication is the Ryerson report on equipment mentioned earlier, and still others are available. To contact the Office of Community Radio, one should write to the address given in the earlier section on Costs.

The Canadian Radio-Television Commission is another possible source of information. They have recently published a report (entitled "A Resource for the Active Community") on various aspects of community involvement in broadcast media--both radio and television. It contains a number of articles, but two may be of specific interest to those new to radio broadcasting. "Community Radio Programming Facilities" provides information on the function and cost of basic radio equipment, and "Community Programme Formats" discusses ways of developing radio (and television) programs. For information on this or other subjects, one should write to the Commission at the address given in the earlier section on Training.

(ii) In certain communities, it may be possible to set up and begin radio operations without incurring the expensive charges associated with transmitter and antenna facilities. The CBC has low power relay transmitters in and outside many small communities in Canada. These transmitters were set up to carry signals from CBC broadcast production studios to communities across the country.

However, it is possible for a community to be linked to those facilities in such a way that they can broadcast their own programs to the community instead of receiving only CBC programs (Ward, 1973).

Not only can this reduce costs to the community by using available transmission facilities, but also it can allow for considerable flexibility which is important in the early phases of station operation. If the community only requires, or has only the resources to prepare programming for two hours per day (or even two hours per week) it is possible to arrange such a schedule, and to have CBC programming when the community is not transmitting.

The CBC has experimented with arrangements providing community access to their low power relay transmitters (LPRT's); however, they are still developing policies on this issue. To determine whether such access might be arranged in a specific community, one should contact the CBC's Office of Community Radio, at the address given earlier. (Of course, such arrangements are only possible in communities located within the range of existing CBC transmitters.)

(iii) Finally, we should note that another type of communication system can be established without the use of broadcast facilities. This would involve the exchange of audio tapes between communities via mail. Tape recorders could be used to produce the tapes, and to play them back. This type of system could satisfy a number of the requirements mentioned earlier, particularly those relating to education, to cultural exchange and preservation, and to the distribution of information on the proceedings of band and council meetings.

The chief disadvantage to such a system is that it reaches a limited number of people at any one time, since the tapes are passed from house to house, or perhaps heard collectively by small groups in a central community location. It also suffers from the reliance on the mail for delivery of tapes.

However, the system would have important advantages which make it an alternative worth serious consideration. For example:

- It is much cheaper than a broadcast station; the major costs involved would be those for tape recorders and tapes, for batteries or AC power to operate the recorders, and for the mailing of tapes.

- It allows greater flexibility in scheduling; instead of requiring listeners to be present when the station decides to broadcast a program, the listeners can arrange access to the tapes whenever it is convenient for them. This may be especially important to people who work set hours.

- Its greater informality may encourage its use by those who might be made nervous or timid by a broadcasting situation.

- It involves a minimum amount of training--easily acquired in an hour or so, with perhaps the help only of the instruction manual provided by the recorder company.

If such a system were to be developed, it would be necessary for representatives from a number of communities to meet and decide on matters such as the types of programs they would each produce, which tapes they would exchange, the number of tapes to be exchanged, and how often the exchanges would take place.

Even where the community has decided to become involved in a broadcasting undertaking, the adoption of a non-broadcast audio tape exchange prior to beginning broadcasting would be beneficial. It provides the opportunity for the development of programming skills which are the essential feature of radio broadcasting, and it encourages the production of a tape bank, or set of programs which would then be available for use when programming begins. It helps to put the emphasis where it belongs--on the programs, rather than on the equipment.

Television

Description: Television is a one-way, audio-visual communication medium in which a signal is transmitted from a central location, and can be received by any television set within its range. Usually, the transmission makes use of the radio frequency spectrum, although it may also employ coaxial cables for signal distribution. The video image may be either black and white, or in full colour.

For reasons to be discussed later, it is unlikely that many communities will actually move to acquire their own broadcast television stations. In light of this, the intent of this section is to give a general overview of the various functions and potential of a television system, and to reserve for more detailed discussion those aspects in which community involvement seems most likely.

In very general terms, then, a television system may be said to consist of the following components:

- program source
- audio mixers
- video switchers
- distribution control
- distribution facilities
- receiving facilities

The program source refers to the type and format of information being input to the system--that is, whether the program originates in a live presentation in a studio or at a remote location, or whether recorded sources such as films, videotape, or slides are used.

Perhaps the most common source of programs is the television studio. This is a specially designed room in which television cameras are used to shoot an event which is prepared for the purpose of being televised. The room must be soundproof, and must have electronic audio and video connections with the control rooms. The equipment found in most studios includes microphones, extensive lighting, and at least two television cameras, as well as whatever background or prop materials (e.g., drapery, desks, chairs, blackboards) that may be needed.

The microphones may be of a variety of types, depending on their intended use. Very small ones may be inconspicuously hung about the neck and appropriately used when there is only one speaker or musician. When the voices of a number of people must be heard--e.g. in a panel discussion or a band of musicians--larger, and multiple microphones should be used. If it is necessary that the microphone not be seen at all, a boom or large crane may be required to support the microphone above the range of the cameras. It is important to remember that specific microphones should be selected for specific tasks--some are better in one direction while others pick up sounds in all directions; some are better for music, while others are primarily intended for use with voices; and some are better indoors while others are constructed to mimimize extraneous outdoor noises such as that of wind.

The extensive lighting found in television studios is required because the television cameras are actually shooting the light

which is reflected off objects. In order to reflect light, the object must first be clearly lit. Ordinarily, the ceiling of a television studio is hung with lights of great and varying intensity; they are suspended so that they may be raised or lowered to required heights, and so that they may be oriented in specific directions. The amount of lighting required will depend on the type of cameras being used (some require more light than others) and on the object being shot (dark objects require more light than bright ones).

The cameras themselves may be of any of various types--some, as just mentioned, are more sensitive to light than others; some are designed to shoot in black and white while others are full colour cameras. Within these variations, there are certain features which are standard on most cameras. Most, for example, have interchangeable lenses, which allow one to get a very close shot (a detail of a plant, for example, or a single face in a crowd) or a very wide shot (perhaps a table full of plants, or a crowd of people). Most of the more recent cameras have a single zoom lens instead of four separate lenses. The function is the same; however a zoom provides a single range of shots rather than four separate angles within that range. Another standard feature is a focus control, which allows one to make the image more distinct. Most cameras are mounted on some sort of structure which allows the camera to be rolled about the studio, to be raised and lowered to varying heights, and to be turned or tilted on its base.

One of the more common examples of such a format is the television news program. A newscaster sits before a desk in the studio, either wearing or facing a microphone (or the microphone may be on a boom above his head). As he reads the news, at least two cameras are simultaneously used to shoot images of him; one may be used for close-ups, while the other concentrates on wide-angled shots of the newscaster and the desk. If he refers to a chart or map or other graphic material, one of the cameras may be moved to shoot that material, and then be returned to focus on the newscaster again.

Other possible program sources include films, videotape, and slide chains. Each of these is a pre-recorded, rather than a live source. The first includes any films produced by a movie camera --for example, feature films or movies that one might see in a movie theatre. Videotape is a means of recording audio-visual information shot with a television camera. It may be used to record from either a large studio camera, or a smaller portable version. Slide chains are simply machines designed to hold and display slides, or small photographic images of still pictures.

When any of these sources are to be used, there must be play-back equipment to allow them to be shown at specific times, and that equipment must be electronically connected to the control rooms so that it may be combined with other signals and distributed or re-recorded as required.

For example, a portable television camera and a videotape recorder may have been used to shoot and tape a news event at a

remote location--perhaps the opening of a new building in the community. Later (continuing our example of the news program) a newscaster might include this videotape as part of his newscast.

Audio mixers can be used to select and/or to mix sound signals from sources such as microphones, tape recorders, and turntables. When a single source is used, the sound level must be controlled so that the output audio signal is sufficiently loud for clarity of reception, yet not so loud as to produce distortion. When more than one source is used, the mixer combines the signals, and controls the sound level of one in relation to the other(s) to produce the desired output signal. The role of an audio mixer is perhaps more complicated in television than in radio since the various sound sources must be mixed so as to correspond with the video images being produced. This may be relatively easy in the case of speech produced through a microphone by the video image, but is considerable more difficult in cases where the sound and the video image originate from different sources.

Video switchers perform similar functions in that they allow one to select from and/or to mix (superimpose) visual images. As we mentioned above, in a studio two or three cameras are usually used to simultaneously shoot an event or an object. One camera may be used for close-ups while another is used for more distant, or wide-angled shots. The images from all cameras are fed into the switcher, and the person operating the switcher must select from those shots one view which is either recorded or broadcast. Often, the person on the switcher will direct the cameras to move so as

to get specific shots which he wants. By pressing buttons or moving levers, he can then change from a close-up to a wide shot, can superimpose the two, or can achieve various special effects such as a split screen, in which different images are shown in the left and right (or top and bottom) halves of the screen. The switcher determines the specific shots eventually seen on home television sets.

The distribution control centre is responsible for the quality of the program, for the combination of images from different program sources, and for program distribution. At this point, adjustments can be made in the video image from live programs to compensate for extremes of light and dark shooting conditions, and for light contrasts within an image. Similar, although more limited controls can be exercised over images from recorded sources.

Just as the switcher selects from the various camera shots available, so the distribution control centre selects from the various program sources available. Because it is connected not only to the studio, but also to playback facilities for recorded programs, it has the responsibility of combining the various types of signals as required to produce a composite program.

It is at this point too that decisions are made as to how widely and in what manner the program shall be distributed. There are several possibilities. It may, for example, not be distributed beyond the station facilities; during the camera shooting, the program may be displayed on monitors in the studio or control

rooms, and no where else. This is usually done only for rehearsal and experimental purposes.

Another alternative involves the distribution of the program to a small network of receivers over a closed circuit system. Schools, or networks of schools frequently make use of this option for educational programs. The various classrooms in a school, and/or the various schools in the network are connected by a system of private wires. A specific program may then be distributed to any or all of these points at a scheduled time, or as requested by specific groups in the system. It is called "closed circuit" to emphasize the fact that access is available only to those belonging to the network.

One may also opt to broadcast the program. In this case, the signal is transmitted via the radio frequency spectrum. It is available to anyone within the transmitter's range having a television set tuned to the frequency over which the signal is broadcast.

The distribution control centre may also be used to record the program for distribution at a later point in time. For example, an interview may be conducted in the television studio and recorded onto videotape. The recorded interview can then be shown in association with a later program, or can be shown at a number of different times as required.

The actual distribution facilities may consist of a transmitter and antenna, and/or of coaxial cables. When television

signals are transmitted via the radio frequency spectrum, they make use of the very high frequency (VHF) or somtimes the ultra high frequency (UHF) bands of the spectrum. In both cases, the transmission characteristics of the bands are such that a direct line-of-sight path is required. Obstacles such as buildings or mountains will tend to block the signal or to reduce it in strength --this is especially true of UHF signals. Also, the range of reception of the signal tends to be rather limited, so that if the signal must be transmitted over a long distance, it will be necessary to construct relay transmitters ~~every thirty miles or so.~~ at distances of thirty to one hundred and fifty miles depending on the power used and the terrain.

Coaxial cables are often used for closed circuit distribution, or in association with a large antenna in a community which receives poor quality signals via the radio frequency spectrum. Coaxial cables are simply large wires which have been specially engineered to carry a lot of information (video, audio, computer) with great accuracy over considerable distances. They are particularly well suited for the distribution of video signals because of their capacity to carry a great deal of information. Video signals consist of much more information than do audio signals, and when transmitted via the radio frequency spectrum occupy a large space in the spectrum. When coaxial cables are used in association with a community antenna to provide better reception, the system is usually termed cable television, or community antenna television, or CATV.

The final part of a television system, the <u>receiving facilities</u>, consist of television sets or receivers, and antennas

for the receivers. The receivers may be of the type generally available for purchase, or of a somewhat modified version intended for use with closed circuit systems. Most television sets, however, have the capacity to receive any of a number of television stations in the area which may be broadcasting over any of a number of frequencies or channels (VHF or UHF). Some closed circuit sets (often termed "monitors") are designed to receive signals on one channel only, but most can be adapted to either closed circuit or regular broadcast operation. Also, television sets are designed to pick up broadcast signals either in black and white or in full colour; that is, a black and white set will show images only in shades of grey, regardless of whether the transmitted signal is in black and white, or in colour.

The antennas for broadcast reception are sometimes of the type intended to be attached to the roof of a building, and sometimes of a more compact design intended for indoor use. The greater the distance from the transmitter, the more likely it is that the larger outdoor type of antenna will be required.

Television systems, because of their fairly limited range, are usually considered a means of intra-community communication. Their signals are normally received adequately only in communities located relatively near to their transmitters. They can, however, be adapted to function as a means of communication between communities through the exchange of videotape programs. This would require that a group or various groups within the community be responsible for the production and taping of programs. These

programs could then be shown over the local television station and later sent by mail to other communities to be shown over their stations. Where television stations do not exist, use can be made of closed circuit or videotape(VTR) facilities to show the programs.

At this point a further word or two about portable videotape equipment is in order. A fairly complete portable VTR system would include the following components:

- television camera
- videotape recorder
- battery or power supply
- playback monitor

This equipment allows one to shoot an event or whatever with the camera, and simultaneously record it onto videotape. The recorder can later be connected to a monitor for playback of the tape. The camera, recorder, battery and battery charger are portable (provided you're fairly strong and don't mind being entangled in wires), and they can be used indoors or out provided some attention is paid to the amount of light available. Because of this, they are very useful in situations where it is not possible to bring the people or the event to a studio, and where power and lighting conditions are inadequate for other types of studio cameras.

If two or more recorders are available, the videotape can be edited--that is, the shots may be re-arranged in time order, or a combination of shots from more than one tape may be produced. One cannot switch with portable VTR equipment ("switch" in the sense described earlier).

A monitor is simply a television set (often a small one) that is designed to accept and playback audio-visual information from a videotape. A regular television set may also be used, provided it is first equipped with an adapter that allows it to accept videotape.

Once a program has been videotaped, it may be shown in one home at a time, it may be displayed over a closed circuit system, or it may be made available for broadcast purposes. As we shall see later, its actual application is limited because of equipment compatibility problems; however, it does have the potential to allow a community to satisfy many requirements.

A television system, whether broadcast or not, is appropriately used whenever a visual image is necessary, or adds considerably to the information being transmitted. It can be particularly useful in education applications, and in the exchange and preservation of cultural information. It has also been used to provide residents information on the proceedings of band and council meetings. These are its important inter-community applications where it is necessary to rely on the mailed exchange of videotapes. Where stations can cover several communities, television can also be used for announcements and for weather reports. As we will note later, the actual use of the medium is severely restricted by its cost.

Potential: A broadcast television signal does not have an extensive range--it is intended for reception in the community or

communities located relatively close to the transmitter. However, within that range, the signal is usually clear in both the audio and video components. As the distance between receiver and transmitter increases, or is blocked by obstacles, reception deterioriates and becomes less reliable.

The picture appearing on the screen actually consists of hundreds of lines of information; each line in turn consists of hundreds of dots--in varying shades of grey on a black and white set, or in a wide range of colours on a colour set. These lines represent information captured by the television camera as it scans an object. The picture is not as well defined as that which we see in reality, because our eyes are capable of receiving much more information than a television camera. However, under appropriate conditions, the picture is certainly quite adequate.

It is important to remember that there will be some loss of definition in going from reality to the screen, however, for this will help in selecting objects and events for shooting. A very small object, a small detail on a large object, or a display with a lot of writin or other graphics may be extremely interesting in reality, but the televised product may be very disappointing unless handled properly. Moreover, portable equipment often provides even poorer definition than does stationary or studio equipment.

On the other hand, television has certain characteristics which seem to alter reality in a way that may be useful. It can be used to show objects from angles not usually employed, or to

show aspects of objects often not noticed. It can be used to portray people and events in distant locations or different countries, and to do so in such a way that viewers have a sense of actually being there. The characteristics of intimacy and immediacy are two very important properties the medium assumes when employed to its full potential.

However, the factor which actually imposes the most serious limitation on the medium is its cost. The necessary equipment is expensive to purchase, and to operate and maintain; programming costs can range from expensive to prohibitive. For these reasons, it is unrealistic to expect that many small or medium sized communities will be able to develop their own television stations. More reasonable approaches include the following:

i) community use of existing television stations

ii) community use of videotape recording equipment

(i) The first makes use of existing television stations and attempts to modify their programming to better reflect community interests. Such arrangements might take a number of firms: community advisors might serve on a committee to advise broadcasters on selection of programs, for example, or the broadcasters might give the community responsibility for developing programming for specific blocks of time.

It is recognized that there are at present few communities in the north that have access to television signals, so the possibilities of this approach are limited indeed. Moreover, where signals are accessible, they are often relayed from distant points,

making it still less likely that residents of small northern communities could have input into programming.

The situation is a difficult one, since the sparse population, vast distances, and harsh weather conditions in the north make extension of an already costly service still more expensive. Eventually, satellite facilities should provide television service where desired in the north, but this cannot realistically be expected within the next few years.

Another related issue is the question of whether or not the community wants television at all. There are many who do, seeing it as an important entertainment and education medium. But there are many who see the coming of television as a threat to the community's traditions and culture. The language of most programming is either English or French, and for those who speak neither of these, television can represent a display of foreign values and customs in a foreign language. The value of such a display is indeed questionable.

Without intending to sound overly negative, there is something of an irresistable quality to television. Most people, regardless of their intention, eventually become television viewers, even if only for short periods. Its possibilities as an entertainment medium draw many people. It is likely that this will also be true in the north, especially in view of the lack of other sources of entertainment, and in view of the increasing exposure to television as travel to other communities increases.

For these reasons, it would be prudent for community residents to collectively decide whether they do or do not want television. If the decision is against television, it is important that this information be made known to those responsible for the extension of television service. If the decision is for television, this too should be made known, and in addition, community residents should provide specific information on the kind of programming they would prefer.

There have been pressures for the development of television production centres in the north, and it is information such as the above which can be influential in the design of programming to eventually originate in the north. Realistically, it may be 3-5 years before any signs are seen of such developments, but the establishment of community groups to make community needs known can help guide the development according to those needs.

(ii) The second approach mentioned above involved the use of VTR equipment. With portable cameras and videotape recorders, community members can shoot their own material, use recorders and monitors to edit the tapes, and then use monitors or regular television sets (with adapters) to show the programs. This is the most inexpensive variation of a television system, and the necessary technology and equipment are readily available.

It is not without limitations:

- Although relatively inexpensive, it is still far from cheap (see information under "Cost")

- The programs can be seen by relatively few people at any one time, since the tapes must be passed from house to house, or seen by small groups in a central community location.

- On an inter-community basis, videotapes are exchanged by mail, and communities must contend with the slowness of this system.

However, as well as being many times less expensive than regular broadcast television, a VTR operation can have other important advantages:

- It requires considerably less training than a broadcast application.

- Greater familiarity with the equipment seems to encourage experimentation in programming.

- It can serve not only as an interim system, but also as a method of developing programs which can be used by established or prospective community stations.

On the latter point, one should note that this is an important and practical way in which communities can have input to regional television stations or production centres. The portable equipment permits shooting on location of aspects of culture or tradition, and the developing of education programs by native teachers in native languages.

As implied earlier, incompatibility of various types and pieces of VTR equipment restricts its actual use in broadcast and other applications. Many of these problems derive from the fact that there are two basis systems of videotape recording: the transverse scanning process, and the helical, or slant track process. In the first (sometimes called "quadrature") four small recording heads put a wide video track--as well as audio and

other tracks--onto two-inch-wide magnetic tape in a transverse fashion, or straight across the tape.

In the second, two larger recording heads put the video information onto magnetic tape in a diagonal rather than a transverse fashion; it also records audio and other tracks along the edges of the tape. Because the video track is recorded diagonally, it takes up less space on the tape, and as a result, the tape can be much larger. In fact, it may be $\frac{1}{4}$ inch, $\frac{1}{2}$ inch, 1 inch, or 2 inches, although most helical scanning tape recorders use 1 inch tapes. Smaller format tape is used on portable video equipment--"portapaks".

At the present time, the portable and relatively inexpensive television camera and VTR equipment is very popular, and manufacturers are attempting to capitalize on that popularity. The competition among manufacturers is very keen, and each is attempting to capture a larger share of the market by putting out different and supposedly better equipment. However, the overall result has been a situation in which tape recorded on one brand of equipment cannot be played back on equipment of a different manufacture, or similar incompatibilities in different models of recorders by the same manufacturer. It is very important to keep this in mind when selecting VTR equipment; if two communities have incompatible machines, tape exchanges will not be possible. One should also be wary of claims by manufacturers that their equipment is compatible with that of other manufacturers--it very often is not, despite their claims.

One should note that this is true only of the helical scanning recorders. Quadrature equipment has been standardized, is interchangeable between machines and manufacturers, and is of very high quality (quadrature or two-inch equipment is usually used for standard broadcast operations). Smaller format equipment, as well as suffering from incompatibility problems, is more difficult to edit, and often does not produce as high a quality picture.

Television is a very complex medium, and because of that complexity, it is more difficult to use, is more likely to malfunction, and is more difficult to repair and maintain. A considerable and sustained effort must be put into both the programming and the technical operation of the medium to produce the desired result. Even then, as we have seen, there are so many variables affecting the functioning of the system that high levels of experience and expertise are needed to reduce the possibilities of failure.

Training: As has just been indicated, most of the dimensions of television operation require a considerable amount of training. Unlike radio, there are few functions which can be learned without extensive and often formal training.

The installation of a television station should not be attempted by community members alone--the equipment is expensive and sensitive, and is unlikely to perform adequately (or at all) unless installed with great expertise. The assistance of those qualified

in television electronics is essential. To reduce expenses somewhat, community members might wish to become involved in the physical installation of the transmitter, and in carpentry work required in the studios and control rooms. It is also advisable to indicate to the installation team preferences relating to the physical layout of the studios and control rooms. In general, though, community members usually rely on the advice of the installation team--they have the requisite skills and expertise, and are far more capable of ensuring proper functioning of equipment than the lay members of any community.

The operation of a television station involves a number of different functions, some of which are more readily learned than others. Here we will simply enumerate and briefly describe the major tasks. There must, first of all, be camera people. Their task is to obtain shots of an event, object or person as required; they must be skilled in the selection of lenses for specific shots, in following their subject smoothly with the camera, and in moving the massive instrument gracefully around the studio. They must also be knowledgeable about lighting effects and be able to compensate with their camera for varying amounts of light. A few weeks training should be sufficient to learn the basics of this task, but several or months or years experience are necessary for skilful and creative operation.

There must be audio people to select, connect and operate the appropriate input devices (e.g., microphone, record), and to test and control the sound levels. This task is one which might

be learned fairly well with a week or so of training, and executed smoothly after a few weeks experience. It should also include knowledge of the characteristics of various types of microphones to facilitate correct selection for specific circumstances.

The person operating the video switcher has a somewhat more complex task. In addition to selecting and mixing video images, he must also direct camera people to take specific shots. The switcher, camera people, audio person, floor manager, control room personnel and director can communicate with one another through headphones. The switcher controls the existing comera shots, and in addition prepares the camera people for their next shots. For example, he may tell one camera to move over for a side shot, or to go closer or further away. The switcher's function is actually more confusing than difficult, for he is interrelating with a number of people and machines simultaneously. With experience, the confusion dissipates, and the job appears much easier than at first. It would probably take a week or so to learn the basic operation of the switcher, and a few months to become skilled in its use.

The floor manager's job, on the other hand, is fairly easily learned. The primary functions of the floor manager include ensuring that the subjects know when to begin and end their presentations, and which way to face when look into the camera. He may also have to help move cameras or cables, hold or turn cue cards, and other miscellaneous tasks associated with ensuring that things are as they should be in the studio. A few days training would probably be sufficient to beginfunctioning adequately.

The control room people must actually be technicians. They must know how to adjust lighting levels for various types of equipment, how to operate playback equipment (videotape recorders, slide chains, etc.), and how to electronically connect various program sources to produce a composite program. It would probably require a few weeks to learn the basic functions, and several months to learn to execute them skillfully.

The director's job involves knowledge of all of these functions--he supervises each of the others to produce a program according to a predetermined script or plan. He tells the switcher which types of shots to get, and the audio person which and how much sound he wants. He tells the floor manager when to give what cues to the subjects, and he also instructs the control room people as to when and what other program sources should be used, and as to how the resulting program is to be distributed. (Depending on the structure of the station, there may also be a hierarchy of directors and producers.) The director usually has some experience in each of the other roles before assuming his position.

In the case of portable VTR equipment, the operations are simplified. There is no switcher, the audio level can be preset, and the control room function would correspond to simply turning on the videotape recorder. The basic operation then becomes that of camera work. It takes only a few hours to learn the steps required to operate portapak equipment. This apparent simplicity is often a disadvantage, however, for with a minimum of instruction, people will rush out and shoot all kinds of tape.

The result is frequently less exciting than had been expected.

It takes much longer to learn how to operate portable equipment well than it does to learn how to simply operate it. To achieve high quality video that can be used to produce an interesting program, one must first pre-plan what is to be shot, and from what angle. It is then necessary to know how various lighting situations will affect the camera and how to compensate for them. It is important to know when to "zoom-in" for a close-up, and when not to, to know how to zoom smoothly, and how to focus when required. Finally, considerable practice and restraint are required to simply learn how to control body movements so that the video image will not be unnecessarily affected by shaky or uneven motion. Many weeks of shooting will probably pass before such skills are acquired.

The editing of videotape is fairly difficult--partly because of the way in which video information is recorded on small format tape. The process can be learned in a couple of days, but may not give satisfactory results even after a few weeks of practice. A small format editing methos has been developed by the National Film Board (see reference in bibliography), but a technical background is required to modify the recorders as they suggest.

Maintenance of television equipment should be left to skilled technicians. Again, the equipment is sensitive and temperamental, and is unlikely to survive the tinkering of unskilled repairmen. A television station would require the full time assistance of a

television electrician to carry out preventative maintenance and to make required repairs. In the case of portapak equipment, any malfunction should also be referred to a qualified television electrician.

Administration of a television station is a multi-faceted job. It involves hiring and training of personnel (operating and maintenance); development of a program schedule; and overseeing the development of programming--both that done by the station, and that acquired from other stations or other sources.

It includes tasks associated with licensing and licence renewal for the station, and with ensuring that the station's programming is in accord with licence requirements. In this regard, it should be noted that the station's equipment must be capable of satisfying set standards of quality, that records of programming must be kept, and that programming must be "in the public interest". For further information on procedures and requirements for licensing, one should write to the following address:

The Secretary
Canadian Radio-Television Commission
100 Metcalfe Street
Ottawa, Ontario, K1A 0C8

In general, it includes overseeing all tasks required to ensure smooth operation of the station, and its most important involvement is in program selection and development. It is unlikely that the overall job could be performed well by anyone without a few years experience in various phases of television

operation. However, various specific aspects--such as that of advising on selection of programs--could be performed by community members with no training, but with a good familiarity with community needs and interests.

The tenor of this section should not be taken as an implication that there is little or no room for community members in television. That was not the intent; rather the intent was to emphasize that full scale television operations require considerable training and experience, and to point out those areas in which it is easiest to become involved. As opportunities for training become available, northerners should take advantage of them--in fact they should be encouraged to seek out such opportunities. It appears likely that television service will begin to become more widespread in the north after a few years. If northerners want to be able to shape the nature of television programming in the north, it is essential that they have the ability to participate in the process. The use of portapak equipment is a beginning; more intensive training is the next step.

Cost: No attempt will be made in this section to specify costs for regular broadcast television operations. Suffice it to say that it is not unusual for a television station to cost several hundred thousand dollars for equipment alone, with salaries and operating costs adding heavily to the expense.

Instead, we will look at the very basics--portable VTR or portapak equipment. Although there are variations among supplier companies, one could expect to purchase a kit consisting of a

camera, videotape recorder, AC adapter and battery charger for about $1800. Since the microphone which is included with the camera is often found unsatisfactory for many uses, one or more auxiliary microphones might be acquired for anywhere from $20. to $100. each.

A playback monitor is required for showing the videotapes. There are monitors designed especially for use with portapak equipment, and these range in cost from about $250. for one with an eight-inch screen, to about $350. for one with an eighteen-inch screen. These monitors can usually also be used for receiving regular broadcast signals. Similarly, a regular television set with an adapter can be used instead of the portapak model. Black and white television sets can be purchased for about $150. to $500., and an adapter (termed an "RF modulator") would cost about $80.

Colour equipment is much more expensive. A colour portapak kit would cost about $6500., and colour television sets tend to start at about $400. Unfortunately, not only is colour much more expensive, but it is also much more temperamental and difficult to use.

Other Information: The Canadian Radio-television Commission has recently published a report for community groups interested in becoming involved in community television and radio. It is entitled "A Resource for the Active Community", and although oriented primarily toward southern communities, it contains a number of articles which might be informative for anyone interested in learning about

community television. There are articles on the function, potential, and cost of various pieces of equipment, and on techniques for producing interesting programs. For more information on the report, one should write to the address given earlier in the section on training.

Before closing this section on television, two points ought to be noted: first, in television--as in radio--the emphasis should be on the programming rather than on the equipment; and second, if one is to exercise control over a medium, it is important that he have familiarity with that medium. The juxtaposition of these two points is of special relevance to the north. At present there is little television equipment in the north, and this may be a disguised blessing. It not only delays the importation of southern signals, but it also can serve to focus northerners' efforts toward program development with the use of simple portable equipment.

That emphasis on program development is in turn an important means of focusing community attention on the question of what --if anything--is wanted from television. Increasing familiarity with this simple equipment both gives communities a chance to sample television, and having done so, to decide whether it would be good for thier community, and if so, in what format.

Film

Description: Many are familiar with film in the form of movies seen at the local theatre. Just as it may be used for entertainment, so too can film be used effectively for many other purposes. In the terms described in the Requirements section, education, cultural exchange and preservation, and information on band and council business are among the more appropriate applications of film.

In many educational systems, film has been used to supplement text books and classroom lectures. It is useful in showing how things are done when the required materials are not available or not appropriate to permit the actual demonstration in the class. It is also used to portray abstract concepts, foreign places, and aspects of events or objects which are difficult for the lay person to see or to understand. Relating more specifically to the needs outlined in the Resuirements section, film might be used to show students a new school which they will soon attend, or to add native content to an existing curriculum by treating a subject or an issue in the native language.

Film is also an appropriate medium for the exchange and preservation of cultural information. Because of its orientation to the visual dimension of communication, it can be used to make a more or less permanent record of those aspects of culture which have an important visual component--particular methods of weaving might be an example of this. It can also be used to form a composite picture of a way of life so that a community may describe their culture to those unfamiliar with it.

When community leaders want to share with residents of their own and other communities information on what took place at an important band or council meeting, they might decide to film the event. Similarly, if an important issue arises on which they wish people to be informed, a film could be made--perhaps describing both sides of the issue so that people could vote on its outcome, or perhaps telling people about changes which they wish to bring about.

Film is not a means of communication between communities in the usual sense of the phrase. It does not rely on wires linking the communities, nor does it make use of the radio frequency spectrum. Instead, a message is recorded onto film in one place, and that film, or message, is taken to different communities for showing there. It is a one-way communication medium, in that the information on the film is presented to the audience. If there is to be feedback, or a return message, it must be by some other means. It is a one-to-many form of communication; the one film can be shared by many people--as many as are able to have access to the place in which it is shown. It is normally an audio-visual medium, displaying images by means of both sound and sight; it may however also be a visual only medium.

For the purposes of this report, film is an inter-community communication medium in that films can be exchanged between communities. If a film system were to be adopted, each community would take on some responsibility for making or otherwise obtaining films on specific subjects. These films are shown in the home

community, and then sent on to other communities for showing there. In this way, a base of common information can be built up among the residents of a number of communities.

The components of such a system can best be described by outlining the processes involved. There are three general phases: the filming, the developing and editing, and the screening, or presentation for public viewing.

In the filming process, an event or object is described on film. A camera is used to show how something is done, to record what happened, or to describe someone or something. For this step, the basic piece of equipment is the movie camera. Cameras are often described along two dimensions: their lens characteristics, and whether or not they record sound.

Movie cameras may either have a fixed or a zoom lens. Different lenses can make an object appear very close to or very far away from the camera. With a fixed lens the angle of view is constant, so that if one wants to change it (e.g. to make the object appear closer or farther away), it is necessary to mechanically remove and replace one lens with another. Three lenses commonly used on movie cameras are 8 millimeter, 16 millimeter, and 35 millimeter lenses. Zoom lenses, on the other hand, have a variable angle of view. By turning a knob or pressing a button, the apparent closeness or distance of the object is automatically changed.

Not all cameras will record sound as well as visual images. Some are silent cameras, intended to portray sight only. However, because a film is made with a silent camera does not necessarily mean that the resulting movie must also be silent. One might use a tape recorder to record the sounds of the event separately, or, one might want to use an entirely different sound track. For example, a film might be made of an event such as the construction of a house, or the weaving of a garment. A separate voice description of how each was done would be made for use with the film. In other cases, music might be an appropriate audio accompaniment to a silently filmed event. There may be certain instances, however, when it is impossible or undesirable to do this. Then a sound camera will be required to capture both images and audio on a single film.

For the filming process then, the required elements include a camera (with perhaps extra lenses), and film--either black and white or colour. A microphone and tape recorder are needed if the sound is to be recorded separately. A camera is light sensitive--an image is formed on the film by light which is reflected off the object through the lens system to the film. In some situations, the natural light may not be sufficient to produce a clear image on the film. In these cases, additional lights will also be required.

In the developing and editing phase, the used film is modified to prepare it for screening. Developing is a chemical process: the light that was allowed to reach the film in the

previous stage changed the surface of the film, but to make that change visible, the film must be treated with chemicals. Once developed, the film shows a series of images that correspond to the various movements of the object that was filmed. A developed film can be screened as it was shot, or, one may want to edit it.

Editing generally refers to the cutting and splicing of the original film to produce a modified version. There are many reasons why editing is done: the film may be too long, some of the shots may not be as interesting or of as high a quality as was expected, or the logic and mood of the final film may require a time-order rearrangement of the original footage.

The developing of film requires access to a firm having dark room facilities designed to handle black and white, and colour movie film. The editing requires a small viewer to examine the film, a splicer to cut and join the film in appropriate places, and cement or tape to make the splice.

The screening of the film is the final phase. The developed and edited (or unedited) film is run through a projector at a specific rate of speed. This projects an enlarged image from the film the film onto a screen, where it can be viewed by those in the room. The projector may be one that has the potential for sound as well, or it may project the image only. The screen is simply a plain sight surface designed to reflect the projected image. In a tight budget situation it can be ignored, and a smooth (often plastered), white or other light coloured wall can be used instead.

If the projector is a silent one, and there is a tape to accompany the film, a tape recorder will be required for playback of the tape during the screening. In addition, some source of power will be required for the projector and tape recorder.

Potential: Film is capable of communicating an excellent visual or audio-visual message to groups of people. Its range is confined to the relatively few feet around the screen, but can be extended in the sense that there may be multiple copies of a film, or in that the film may be sent to various groups. It is primarily a one-way medium of communication, and is not appropriately used where time is an important element, simce film is slow in the making, and must rely on mail for distribution.

In its visual component, film is unsurpassed for accuracy and detail. Its definition is much finer than that which can be attained via television, and, if properly filmed, its colour tends to be truer than that characteric of television. The careful selection and presentation of shots can result in a very powerful means of communication that not only provides information, but which has a strong emotional impact.

However, that power is not easily elicited. It is difficult technically for a number of reasons. The developing is time consuming, and must be done carefully, or the film can be ruined, or of poor quality. Editing is not only time consuming, but can also be messy and difficult. When the sound and the visual components have been recorded on the same film, editing is especially

tricky, since the sound precedes the accompanying picture on the film.

It is difficult too from the point of view of planning and producing the film. One should have in mind beforehand a clear idea of what is to be shown, how, and in what order. Decisions will have to be made as to how much information is to be given--and as to what is to be clearly spelled out, and what left to the audience's imagination.

If there is to be a sound track, thought must be given to whether it should be that produced by the picture, or whether it should be separate. In the case of the latter, it will be found that at times music is appropriate while at other times voices or other sounds are more effective. A considerable amount of experimentation is required before a film is brought to its full potential.

In short, film can be a very powerful and effective means of distributing an audio-visual message, but the process is a slow and difficult one. Also, as we shall see later, it can be a fairly expensive undertaking.

Training: The categories that we have previously used to describe the required training are less relevant in the case of film. Because most of the equipment is portable rather than stationary, and because neither lines nor the radio frequency spectrum are used for transmission, there is no installation in the usual

sense of the term. The cameras and projectors are used where required, and are set up temporarily when required.

One exception to this is the situation which involves the establishing of a permanent location for screening films--for example, a theatre, or a more modest screening room. In either case, it may be desirable to build a high projection room or stand for the projector so that it will always be above the heads of the viewers. Other steps may also be taken to make the screen and the seats more permanent fixtures of the building or room. These are improvements which can usually be made with the assistance of a local carpenter.

Maintenance requirements are centred on the cameras and the projectors, and on tape recorders if they are used. Except for minor tasks such as cleaning lenses, camera maintenance should not be attempted by anyone without a high level of training and technical expertise in camera repair. They are very sensitive and complicated instruments, and can easily be put out of commission totally by uninformed tampering. They are expensive and deserve the care that can only be provided by highly trained people.

Projectors and tape recorders are less complex instruments, but they too require the assistance of a skilled technician in the case of malfunctioning. Again, there are tasks--such as the cleaning of recording heads, and the replacing of bulbs and cleaning of lenses on the projector--which can be undertaken with little or no training. The manufacturers usually supply little booklets which describe how, and how often these steps are to be taken.

For the more major repairs, unless there is a local firm skilled in camera, projector or recorder repairs, theses instruments may have to be sent back to the manufacturer. Often, this does them little good, especially where distances are great and different means of transportation are used.

The major involvements in film can be described under the heading of operation. We will consider film operation in the three processes introduced earlier:

- filming
- developing and editing
- screening

Included in the filming phase are all steps necessary to record an image on film. It may be as straightforward as loading the film into the camera, checking light settings and making appropriate adjustments, and then shooting the event or object by depressing a button.

If the event is to be staged, or preplanned (for example, a concert or a play) it may be necessary to have rehearsals, and to add to or otherwise modify the lighting. If sound is to be recorded simultaneously, still other measures must be taken. When a sound camera is used, it is necessary to determine whether the microphone contained in the camera is adequate, or if an auxiliary microphone will be required. When the sound is recorded separately with a tape recorder, appropriate microphones must be selected, placed so as to pick up sounds as required, and tested to set recording levels.

The required skills for the filming process, then, include knowledge of camera operation, of lighting conditions, of microphone characteristics, and of audio recording. These functions may be performed by one, or by many people, depending on the complexity of the situation. The basic skills are easy to learn: the steps are usually outlined in instruction manuals supplied by the manufacturer.

However, knowledge of the basic operational steps does not ensure a quality product. For example, it is fairly easy to load and run a camera. But a far more important factor is what is shot and how one goes about it. There are many variables affecting the impression obtained from a film: if the camera shoots film of a person from below, that person appears powerful and authoritarian; if the lighting is from below, however, the person can be made to appear very sinister and evil. These are but two examples of the many things to be learned after one begins to make films. The basic instruction in operation may take a couple of hours, but it is likely that a couple of years will pass before one's films begin to be interesting.

The developing of movie film is not a step which should be taken on by community members. It involves judicious use of chemicals, and careful timing and handling. To achieve a high quality product--especially with colour film--the developing should be left to processing houses or firms that have the requisite skill and facilities.

The editing, on the other hand, is a step over which those responsible for the film should have control. It is time consuming; one must sit and view all of the original footage, and gradually decide what should be included and what eliminated. The order must be considered, for it may be that ideas can be presented more clearly or more forcefully if presented in a time sequence different from the original filming order. Attention must be paid to the changes from one scene to the next so that they won't appear too abrupt or inappropriate.

Again, the steps involved in editing may be learned in a few hours, but it takes much longer before the process can be executed skillfully. Once the exact section to be removed is found, it is marked, and a splicer is used to cut the film. The splicer also holds the cut film in place so that a different piece of film can be joined to it. The joint is made by means of cement or tape; the former is more time consuming, but some feel it forms a better and more durable bond. Weeks or months of practice and of viewing the results will lead one to develop his own preferred technique, and to produce an edited product that becomes increasingly more satisfactory. When the sound has been recorded on the film, it will take longer to learn the basic steps, and to develop skill in the editing.

When the sound track is recorded separately and/or is different from the sound produced by the picture, an audio editing must also be done. This will involve modifications to tapes to make them correspond to modifications in the picture. It also

involves the selection of additional sound--such as music-- for certain parts of the film. It will be necessary to know how to edit audio tapes, both mechanically through cutting and splicing, and electronically through re-recording. Knowledge of a wide variety of music and its emotional characteristics is also important. The editing of the audio track is made considerably more difficult than in radio by the fact that the audio must correspond to and complement the visual images.

The screening process, on the other hand, is quite simple. It involves loading the film onto the machine, and turning it on and adjusting the focus--steps readily learned from an instruction manual with a few hours practice. The job becomes a bit more complicated if the person must also operate a separate audio source, for example, a tape recorder. It takes some practice to operate the two so that they are synchronized with one another, but it is not really a difficult matter.

The administration of a film system principally revolves around making arrangements for the showing of films. This would involve requesting a film from a local or other source, booking an appropriate space to show the film, announcing the time and location of the showing, and arranging for the equipment and projectionist. If a charge is made for the showing, the administrator would be responsible for overseeing its collection and appropriate disposal.

If the community owns the filming equipment collectively, there would be other administrative duties involving ensuring that the equipment is in good condition and arranging for repair

when required, lending it out to community members as they need it and as it becomes available, and ordering supplies such as film. Depending on the extent to which a filming group has been formalized, the community may want to assign administrative tasks to one person, or many wish to take them on collectively, in an informal manner.

In short, the most important part of a film operation has little relation to the equipment. It is the careful selection and treatment of the issue which is of essential concern, and this is usually achieved only through years of experience.

Cost: Although as mentioned earlier, 8 mm., 16 mm., and 35 mm. lens cameras are commonly used in film making, they are not used equally often, nor by the same people, nor for the same purposes. The 35 mm. camera is very much the tool of the professional--it is extremely expensive, and is used sparingly by professional cameramen in Hollywood-type undertakings. No more will be said about it here.

The 16 mm. camera is less expensive and is frequently used for films to be used on television, and for some semi-professional projects. One should not be led to believe that it is cheap however. The camera alone can range in price from $1200. to $18000. for those without sound, while those with sound start at $7000. or so, and go on up. Again, no more will be said about it here.

Instead, we will concentrate on the 8 mm. type of camera. This is considered an amateur's camera, and does not in fact give

as good results as the other models. However, its price range is much more reasonable, the cameras are easy to use, they give an acceptable product, and they are gradually being improved as their popularity grows. (They are often referred to as "super-8" cameras.)

The cameras can be obtained with either a fixed lens or with a zoom lens, although many people prefer the zoom because of the flexibility it gives them in angle of view. Both fixed lens and zoom lens cameras can be obtained in silent and sound models; generally, cameras with zooms and sound are more expensive than those with fixed lenses and those that are silent. One could obtain a fixed lens silent camera for about $100., and a zoom silent camera for about $200. A sound camera with a zoom lens would start at about $300., and many are around $500. Either black and white or colour film can be used with the cameras; it starts at about $3. for a 50-foot black and white cartridge and about $5.50 for a 50-foot colour cartridge. Processing costs will vary somwhat with locale, and will be higher for colour; one should expect to pay at least $3. - $5.

Editing equipment for super-8 film footage can be purchased for about $100., and includes a viewer and a splicer.

Projectors are available for use with super-8 in both silent and sound versions. The former costs about $200., and the latter about $600. One should note that cheaper projectors are available; there are some for under $100., but it is important to check to see if they will accept whatever type of film one intends to use on it.

Although, as mentioned earlier, a smooth light-coloured wall can substitute for a screen, the latter will reflect a clearer image. They vary in cost depending on quality and size; they start at about $15. and go up to several hundred dollars.

When separate microphones and tape recorders are required, one should expect to pay $20. to $100. for a microphone (more than one may be needed). Tape recorders of the cassette variety cost about $100. to $150., and those of the open reel type start at about $300.

These costs are estimates, intended only to provide some idea of the magnitude of the expenses involved. They will probably vary from one region to another, and will be higher when freight charges are added. They are not necessarily indicative of the cheapest model in a class--rather they indicate the price one will probably have to pay to obtain a reasonably durable instrument of acceptable quality.

Other costs associated with a film system include those for a power source, for a screening location, and for salaries for cameramen, editors, and projectionists, and these may involve a lot or very little money, depending on the resources available in the community.

Most projection equipment is designed to operate off a commercial source of AC electricity. Where this is not available, an attempt should be made to obtain battery operated equipment, or to utilize a generator to produce the required power. The

costs of batteries, of electricity, or of the generator and gasoline to operate the generator would then add to system costs.

The screening location may be someone's home, or may be a building designed especially for the purpose of showing films. Which is used will probably depend on what facilities are available in the community and how often films are shown. If a building is used for that specific purpose, the costs of rent, heat, and light must be calculated, as well as those for any renovations required on the building.

Whether the community pays those people involved in film making, or relies on volunteer assistance is again dependent on the resources available in the community. If there is little money available, and if the need for films arises infrequently, qualified community members might be persuaded to work voluntarily. However, when filming and screening become regular and frequent events, it will probably be more satisfactory to all concerned to work out a pay system.

Other Information: If it is anticipated that there will be only a few occasions on which film will be needed, consideration should be given to renting rather than purchasing equipment. Many of the retailers who sell cameras and projectors also are often willing to rent them. This possibility might be explored with them before a decision is made to purchase.

The rental of equipment and its infrequent use does have the disadvantage that there is little opportunity to develop skill in camera work, or in other aspects of production. When this is the case, thought should also be given to hiring a professional camera person to assist in making the film. Community members should then tell that person what form they want the film to take, and in turn would be well advised to listen to his suggestions as to the best way to go about it.

Those interested in learning about other things being done with film or in becoming more involved in the medium might find the National Film Board of Canada an important source of information. The NFB has for years been involved in many aspects of film in many parts of canada, including remote and northern communities. They represent a storehouse of technical expertise and film know-how; they also have a store of films which they can make available to communities.

The NFB is co-sponsor of a program called "Challenge for Change", which involves the use of various media as instruments for bringing about imporvement in communities. Many of the projects which have been carried out under this program--as well as simply information on the media--are described in their newsletter, called "Access". This newsletter is published about three or four times per year, and can be obtained free of charge by writing to the following address:

Access
Challenge for Change/Societe Nouvelle
National Film Board of Canada
P.O. Box 6100
MONTREAL, QUEBEC H3C 3H5

SUMMARY

In this report an attempt has been made to bring together information on the requirements and alternatives for inter-community communication in the north. It is an extremely difficult task because of the varying levels of needs and priorities in the north, and because of the varying levels of sophistication and extension of communication technologies in the north and elsewhere. It is not pretended that this report does justice to the amount of information available, nor to the amount of information required on the subject. It should instead be taken as an effort toward partial information sharing, and as an encouragement to further and more precise steps in the same direction.

The first section of the report--Requirements--concentrates on the needs that northerners have delineated in the area of inter-community communication. Nine types of use were defined, some of which had a number of different aspects. It is hoped that northerners might find this section useful in helping them define their needs for inter-community communications, and to establish priorities for those needs--both in relation to one another, and in relation to needs in other areas.

The second section of the report--Alternatives--describes various means of communication which might be used to satisfy the Requirements outlined in the previous section. The task of this section was made difficult not only by the various degrees of detail with which each system could be described, but also by the differences in technical background of those who might be potential

readers. It is inevitable that the section will be found trite by some, and yet by others will be found to contain needlessly complicated material. It was intended to provide a general basis of information on seven types of communication systems; in each case, a description, an evaluation of the potential and of training requirements, costs, and other information have been provided. The section is long, but is set up in discrete subsections so that one may obtain information only on the specific system(s) of interest to him.

While keeping in mind the fact that certain terms have been used with fairly specific meanings in this report, the information on Requirements and alternatives can be schematically brought together as follows:

Requirements	Possible Alternatives
Emergencies	HF radio, telephone, teletype, trail communications
Education	HF radio, telephone, teletype, radio, television, film
Cultural exchange, preservation	HF radio, telephone, teletype, radio, television, film
Announcements of meetings, gatherings, etc.	HF radio, telephone, teletype, trail, radio, television
Band and council business	HF radio, telephone, teletype, trail, radio, television, film
Information from government agencies	HF radio, telephone, teletype
Weather reports	HF radio, telephone, teletype, trail, radio, television
Plane, ship movements	HF radio, telephone, teletype, trail, radio
News of events, friends, relatives; chatter	HF radio, telephone, teletype

The order does not imply preference or priority, nor do multiple listings imply a need for all of the Alternatives. They are each possible solutions, each with its own set of advantages and disadvantages. Information is presented on each to better equip community members to decide which, if any, would be appropriate for their specific application.

Finally, mention should be made of two other types of need which were mentioned only indirectly in the body of this report; these are the need for training, and the need for information. Much today is being said about having the residents of the north assume more control over their communities, lives, and futures; it seems to be a goal which most will deem valuable. However, lack of training and of information are important factors in deterring northerners from reaching this goal.

Where the blame lies for this situation is another issue; but unless the situation is corrected, it is unlikely that northerners will be able to assume the control they desire.

In the area of communication, the following steps might be considered in an effort to bring about change:

- community residents, and groups of communities could meet and collectively define the communications needs of their communities;
- where existing facilities are providing an unacceptable service, community members could meet with those responsible and explain to them the changes they would like to see;
- members of communities could be assigned the responsibility of obtaining detailed information on required communications systems, and on suppliers of communications services;

- many native northern groups have already had experience with certain systems; they could be contacted in an effort to obtain more information and an evaluation of system performance;

- southern-based industries which have established in the north could be contacted in an effort to develop a sharing system for communications facilities or training;

- when it becomes obvious that certain skills will be required on an ongoing basis, certain community members should be encouraged to seek out specialized training so that those skills may become more widely resident in the north;

- northerners could seek to establish their own training centres in the north where those having received specialized training in relevant areas can assist others in the same, and can do so in native languages.

Undoubtedly many of these have been attempted in the past, and some have been successful while others have been failures. In spite of disappointments, it is important that the people of the north strive to be better informed, and to continue to exert pressure for the changes they want.

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