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UHF MULTI-PURPOSE
SATELLITE COMMUNICATION SYSTEM
ANALYSIS OF POTENTIAL
USE AND BENEFITS OF FIXED,
TRANSPORTABLE AND
MARINE MOBILE EARTH STATIONS

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LIST OF ABBREVIATIONS

UHF	Ultra High Frequency
MOT	Ministry of Transport
DND	Department of National Defence
DIAND	Department of Indian-Eskimo Affairs and Northern Development
EMR	Department of Energy, Mines and Resources
DOE	Department of Environment
DOC	Department of Communications
FF	Fisheries and Forestry (now part of DOE)
NHW	Department of National Health and Welfare
C&E	Customs and Exise
DPW	Department of Public Works
RCMP	Royal Canadian Mounted Police
PO	Post Office
DREE	Department of Regional Economic Expansion
SS	Secretary of State
NRC	National Research Council
CBC	Canadian Broadcasting Corporation
HF	High Frequency
GTA	Government Telecommunication Agency
ATC	Air Traffic Control
VHF	Very High Frequency
O/M	Operations and Maintenance
UNESCO	United Nations Educational, Scientific and Cultural Organization
ATS-1	Applied Technological Satellite Number 1
RAND Co.	Research and Development Corporation

1. INTRODUCTION

This study was undertaken for the Requirements Analysis Division of the Space Systems Planning Branch of the Department of Communications. The aim was to provide an initial assessment of the potential use and benefits that would accrue to civilian users from the establishment of an Ultra High Frequency (UHF) multi-purpose satellite communications system.

Such a system would provide voice and data communications to users in remote areas with quality and reliability equivalent to that which is provided at the present time in populated regions. The service would be of interest to government departments, industries, as well as to communities and individuals who require communications in remote regions. Specific applications might include radio broadcast transmission, telephone service, teletype service and facsimile service to remote communities as well as data transmission from unmanned sensors and transmission from aircraft crash position indicators. Uses and benefits for the latter two applications were not included in this study.

The aim in determining potential use and benefits associated with such a system, is to provide a basis from which the design of the system can be extended, its desirability assessed in depth, and some basic cost-revenue implications examined.

Results of the study indicate strong interest among potential users of such a system. Details of those users and of potential application areas are contained in the body of the report, along with both qualitative and quantitative estimates of benefits wherever possible.

2. CONDUCT OF THE STUDY

The study was completed in three stages; a list of potential users was prepared, from the list a sample was selected for detailed investigation, and finally, an examination was carried out to determine the potential use and benefits for each user in the sample.

This section of the report will describe each stage of the study in detail.

(a) Preparation of a List of Potential Users and Applications

As a first step, an outline of the UHF multi-purpose satellite communication system capabilities was developed (see Appendix I). This statement of the system's capabilities was then used as a basis for identifying potential users. These were divided into two groups, according to whether they were inside the Federal Government or outside. (See Tables I (a) and I (b) respectively.) In the Tables, individual users are listed vertically on the margin and applications are shown at the head of each column across the top of the page. Federal Government users are separated into various departments concerned, while for users outside of Federal Government, general groupings along industrial lines were used with separate groupings for provincial government departments, Northern communities and other users.

(b) Sample Selection From the Initial User-Application List

A limited sample of user-application areas were studied. This was done to limit the scope of the study while at the same time providing as

TABLE I (a) POTENTIAL USERS WITHIN THE FEDERAL GOVERNMENT

POTENTIAL USER	VOICE AND DATA			RADIO BROADCASTING
	FIXED	TRANSPORTABLE	MOBILE	
<i>MOT</i>	+	+	+	
<i>DIAND</i>	+	+		
<i>EMR</i>	+	+		
<i>DOE</i>	+	+		
<i>DOC</i>	+	+		
<i>FF</i>	+	+	+	
<i>NHW</i>	+	+		
<i>C&E</i>	+	+		
<i>DPW</i>	+	+		
<i>RCMP</i>	+	+	+	
<i>PO</i>	+			
<i>DREE</i>	+			
<i>SS</i>	+			
<i>NRC</i>	+	+		
<i>CBC</i>	+			+
<i>OTHER</i> *	+	+	+	

LEGEND





- * - INCLUDES ALL OTHER FEDERAL DEPARTMENTS
- † - INDICATES POTENTIAL USE
-  - QUALITATIVE DESCRIPTION AVAILABLE
-  - QUANTITATIVE ESTIMATES PROVIDED

TABLE 1(b) POTENTIAL USERS OUTSIDE THE FEDERAL GOVERNMENT

POTENTIAL USER	VOICE AND DATA			RADIO BROADCASTING
	FIXED	TRANSPORTABLE	MOBILE	
<i>PETROLEUM INDUSTRY</i>	+	+	+	
<i>MINING INDUSTRY</i>	+	+	+	
<i>CONSTRUCTION INDUSTRY</i>	+	+		
<i>TRANSPORTATION</i>	+			
<i>PROVINCIAL GOVERNMENT</i>	+	+	+	
<i>POWER COMPANIES</i>	+	+		
<i>NORTHERN COMMUNITIES</i>	+	+		
<i>LOGGING COMPANIES</i>				
<i>OTHER</i>				

LEGEND

- + - INDICATES POTENTIAL USE
-  - QUALITATIVE DESCRIPTION AVAILABLE
-  - QUANTITATIVE ESTIMATES PROVIDED

broad as possible an indication of potential uses and benefits. In line with this approach, two criteria were used in selecting areas for investigation. These were a prior estimate of potential use and a subjective assessment of the availability of information in each area. These considerations led to those areas shown shaded in Tables I (a) and I (b) being examined.

As indicated in the Tables, the investigation focussed on voice and data communications, with radio broadcasting included only with regard to one user, the CBC.

(c) Examination to Determine Potential Uses & Benefits

The survey was carried out by contact with potential users. Initially, this was by telephone and subsequently, either by correspondence or through telephone contact and meetings. When meetings were arranged, the approach was first of all to brief the user on the capabilities of the UHF satellite system; subsequent to this, discussions were held concerning the potential applicability of the system to users and operations, and also included a qualitative aspect of benefits that might accrue to users through use of the UHF system. Meetings therefore had the dual effect of acquainting the user with details of the UHF satellite system, and helping to focus on his requirements.

Information obtained from telephone calls, meetings and correspondence with potential users was supplemented by other data available from the Requirements Analysis Division and also from written material made available by potential users.

The quantitative data was obtained from the Government Telecommunication Agency survey of communications within the Federal Government (1971) as well as from other publications as recorded in the bibliography (1).*

Shading in Tables I (a) and I (b) indicate whether quantitative or qualitative results were obtained for the user-application areas studied.

* This symbol at the end of a sentence refers to the publication as listed in the Bibliography.

3. RESULTS

Results are divided into two sections, quantitative and qualitative. The first deals with a quantitative assessment of potential use by user-application area, in accordance with the information given in Tables I (a) and I (b). The second part contains a qualitative assessment of potential use again, in accordance with Tables I (a) and I (b).

(a) Quantitative Estimates of Potential Use

These estimates are based on estimates of existing high frequency radio use. It is assumed that a multi-purpose satellite system could substitute for existing HF radio applications in most instances and accordingly the current potential for such a system is equated to this existing use. Even though the estimated satellite use has been equated more or less to the present HF radio use, there is a considerable growth factor that could be included after detailed studies have been completed. This growth has two sources. The first results from new settlements and industries that need communications. The second source is called the stimulation factor. New communication systems tend to become overloaded much sooner than designers expect because the growth rate is not constant.

Tables II (a) and II (b) show estimates of existing long range HF radio use for fixed, transportable and marine mobile installations among the selected users. The use is distinguished as long range because there is an extremely large number of HF radio sets used for short distances, that would not be replaced by a UHF satellite station. The HF radio use estimates are conservative, especially in the private sector, since contact was possible with a very small segment of the petroleum industry.

TABLE II (a) EXISTING FEDERAL GOVERNMENT HF RADIO USE

USER	VOICE AND DATA			RADID BRDAD CASTING
	FIXED	TRANSPORTABLE	MDBILE	
<i>MOT</i>	400-500	5-10	20-40	
<i>DIAND</i>	220-230	60-75		
<i>EMR</i>		50-90		
<i>DOE</i>		10-20		
<i>DOC</i>				
<i>FF</i>				
<i>NHW</i>		15-20		
<i>C & E</i>				
<i>DPW</i>				
<i>RCMP</i>	120-130	20-40	5-10	
<i>PO</i>				
<i>DREE</i>				
<i>SS</i>				
<i>NRC</i>				
<i>CBC</i>				
<i>OTHER</i>	150-200		10-20	

TABLE II(b) EXISTING HF RADIO USE OUTSIDE THE FEDERAL GOVERNMENT

USER	VOICE AND DATA			RADIO BROADCASTING
	FIXED	TRANSPORTABLE	MOBILE	
<i>PETROLEUM INDUSTRY</i>	100-200	75-100	40-60	
<i>MINING INDUSTRY</i>	50-100	25-75	10-20	
<i>CONSTRUCTION INDUSTRY</i>	50-100	5-10		
<i>TRANSPORTATION</i>			20-40	
<i>PROVINCIAL GOVERNMENT</i>				
<i>POWER COMPANIES</i>				
<i>NORTHERN COMMUNITIES</i>	125-150			
<i>LOGGING COMPANIES</i>	100-200	50-100		
<i>OTHER</i>	170-200			

Many of these estimates for federal government users were taken from a GTA survey that was completed in 1971, with estimates for 1975. Some of the estimates were taken from a Yellowknife Conference Paper by O.S. Roscoe (2). Estimates for the petroleum and mining industry are simply that, based on known activity in the petroleum and mining industry conservative estimates for fixed facilities were made. The Canadian Petroleum Association provided estimates of transportable use which were used to make estimates in the petroleum industry.

These estimates could be made very accurately by searching the DOC licensing records. However, one would have to make estimates as to which HF radio sets would be retired by the UHF satellite system.

In what follows, each of these application areas is discussed separately, and estimated potential satellite system use is given in Tables III (a) and III (b).

Tables III (a) and III (b) summarize the fixed installation, transportable unit and marine mobile potential use. The users are listed down the left side and the estimated use is on the right hand side. The user "Northern Communities" represents the potential needs of the federal and provincial government departments as well as private users located in communities. At the present time, each user maintains his own HF radio but the UHF system would permit everyone to use the village system.

Some of the industries are shown as separate users since they are often located outside the villages and would want communications to the industrial site. Some of the industries are shown as separate from

TABLE III(d) QUANTITATIVE ESTIMATES FOR UHF SATELLITE STATIONS IN THE FEDERAL GOVERNMENT

POTENTIAL USER	VOICE AND DATA			RADIO BROADCASTING
	FIXED	TRANSPORTABLE	MOBILE	
<i>MOT</i>	50-100		20-40	
<i>DIAND</i>		70-120		
<i>EMR</i>		100-130		
<i>DOE</i>				
<i>DOC</i>				
<i>FF</i>		20-40		
<i>NHW</i>		10-20		
<i>C & E</i>				
<i>DPW</i>				
<i>RCMP</i>		10-20		
<i>PO</i>				
<i>DREE</i>				
<i>SS</i>				
<i>NRC</i>				
<i>CBC</i>				2 CHANNELS
<i>OTHER</i>		25-50	5-10	

TABLE III (b) QUANTITATIVE ESTIMATES FOR UHF SATELLITE STATIONS OUTSIDE THE FEDERAL GOVERNMENT

POTENTIAL USER	VOICE AND DATA			RADIO BROADCASTING
	FIXED	TRANSPORTABLE	MOBILE	
<i>PETROLEUM INDUSTRY</i>	100-150	75-100	30-60	
<i>MINING INDUSTRY</i>	50-100	25-75		
<i>CONSTRUCTION INDUSTRY</i>	5-10	5-10		
<i>TRANSPORTATION</i>			10-20	
<i>PROVINCIAL GOVERNMENT</i>		50-100		
<i>POWER COMPANIES</i>				
<i>NORTHERN COMMUNITIES</i>	200-250	10-20		
<i>LOGGING COMPANIES</i>	50-100	25-50		
<i>OTHER</i>				

the village because they desire a dedicated system. The MOT user is separate because required communications is for lighthouses which are in isolated locations.

The radio broadcasting application has good potential for use by the CBC, to the extent of two full channels. The potential saving in capital expenditure alone is estimated at over \$5 million. A detailed analysis would have to be carried out to determine possible economics in operations and maintenance.

These estimates are not intended as commitment on the part of the user. The estimates have been compiled to demonstrate what the potential market for this system might be. This qualification applies to all tables.

(b) Qualitative Potential Uses & Benefits

In approaching prospective users, it was frequently difficult to obtain an accurate quantitative assessment of potential use and benefits. The reasons for this were twofold; on one hand, such an assessment would require considerable effort and expense on the part of the user, and second, even if resources to undertake such a detailed analysis were available, published technical and cost data on which to base the study were not yet available from the system designers. Attempts to assess potential benefits by proxy methods proved unsuccessful because good data could not be obtained or the validity of available information was questionable. Because of these factors, much of the investigation focussed on a qualitative assessment of uses and benefits. Discussions did however reveal that potential users would be willing to undertake detailed studies in their own areas once refined system cost and performance data becomes available.

The results of this section are shown for three application areas: fixed and transportable installations, and radio broadcasting. Within each of these, users included in the study are discussed separately, as follows;

Fixed Installations

Ministry of Transport

Indian-Eskimo Affairs and Northern Development

National Health and Welfare

Petroleum Industry

Provincial users

Other users

Transportable Units

Ministry of Transport

Indian-Eskimo Affairs and Northern Development

Energy, Mines and Resources

Royal Canadian Mounted Police

Petroleum Industry

Provincial users

Other users

Radio Broadcasting

The Canadian Broadcasting Corporation

(i) Fixed Installations

1. Ministry of Transport (MOT)

This department requires communications in every phase of its operations. Often one would be hard pressed to separate the communications from the operation. In other words, the communications themselves are the total operation. (15), (5), (9).

The Ministry of Transport is responsible for Air Traffic Control (ATC) within Canada. ATC requires good communications to perform the task properly and very often the type of equipment available on the market suffers from the same problems as the HF Radio Telephone System. The number of locations in the north where private aircraft companies must maintain their own private facilities, when added to the number of locations that MOT maintains, is considerable. These private and government maintained systems are still inadequate. MOT could use the UHF satellite system to provide complete Canadian ATC facilities. This could be completed by installing many small unmanned ground repeater stations that would act as the air to ground link for the aircraft. The radio signal would then be sent by the ground station to the satellite and from there to the manned control centres. This method would provide a reliable ATC system at a reasonable cost. The aircraft cannot use the satellite directly because present technology is too expensive for private aircraft.

Many locations in remote areas that use land lines for communications are without service while repairs are made because the lines are down from snow, flood, or even trees falling on the wires.

Good weather data is needed for air travel. Weather maps could be quickly and accurately sent using an inexpensive facsimile machine. HF radio cannot utilize this simple data device under poor reception conditions. As the traffic volume increases, this type of device will be needed to improve ATC, and continue to make air travel safe. The ATC people are interested in improving their facilities whenever their budget permits.

There are other programs within MOT that depend heavily on good, reliable communications. The lighthouse automation program is dependent on reliable data communications to monitor and control the operation of the automated lighthouse beacon. Today, some of these stations are connected by landline and VHF radio links. There has been interest shown by MOT staff to transfer the lighthouse monitoring program to a more reliable and possibly more economical UHF satellite system. The lighthouse system has 300 lighthouses that could be automated. The present landline charges amount to \$226,000 per year. This program could realize substantial benefits from the implementation of the UHF satellite concept.

There are other programs in MOT that require better communications. These programs can only be identified after detailed investigation by an MOT study team. However, one of the MOT external agencies has been contacted, the Northern Transportation Company Ltd. The representative indicated that they spend nearly one hundred thousand dollars per year on an HF radio network that could easily be replaced by a more reliable system such as the UHF concept. He felt that a better system would provide improved service to Northern Transportation customers. A list of 75 radio systems that MOT maintains is available in Appendix II.

2. Indian-Eskimo Affairs and Northern Development (DIAND)

The Department of Indian-Eskimo Affairs and Northern Development (DIAND) operates as a central control agency with the provincial authorities actually dealing with the people. Thus, DIAND deals with provincial capitals. There is no problem with communications equipment to the capitals. However, in dealing with the territories (Yukon and Northwest), DIAND actually maintains some staff in the field outside the capital regions. Here, problems in communications arise. Indeed, even in the provinces, difficulties occur when personnel in Ottawa try to contact on-site control officers or project leaders. Existing telephone facilities via radio link to the remote villages are not reliable or of good quality. (14).

The Indian-Eskimo Affairs program needs better communications in all remote villages so that provincial and territorial government staff can be reached and so that the residents can maintain contact in and around the village. The DIAND personnel would use the village system or the future facilities maintained by the common carriers.

DIAND maintains staff in all the National parks and therefore, owns an array of communications equipment (see Appendix III). New parks will require additional equipment.

The Northern Development Program needs better northern communications as a means of improving enterprise in the north. At the present time, private companies must maintain their own radio networks. Some examples are the Hudson Bay Company, Northern Transportation Company and

several air transportation companies. These networks are independent and compete with each other for radio spectrum. In addition, when ionospheric conditions are not suitable, all the networks are useless. A UHF satellite system would provide a consolidated reliable network of much better quality than those companies now have.

As new areas are developed, the demand for additional radio communication will increase the network interference, which contributes to the poor quality of service at the present time.

DIAND officers have stated that they use a growing number of facsimile transmission equipments. This instrument is likened to a page copier that can be attached to a telephone line and the page to be copied is sent to the receiving station. This device enables DIAND to eliminate the long mail service. Unfortunately, HF radio will not permit this machine to be used regularly. Therefore, the UHF concept would be very useful for this type of application where good quality of transmission service is needed.

Indications from DIAND are that travel can be reduced up to 25% when good, dependable telephone service is available. This factor could result in sizeable improvements in service that a department could provide with the same operating staff and funds.

3. National Health and Welfare (NHW)

The Federal Department of National Health and Welfare maintains hospitals, health clinics, and nursing stations throughout the remote

regions of Canada. A complete description of potential use of the proposed UHF satellite system with resulting potential benefit to NHW Northern Medical Services is in Appendix IV. This appendix also contains the complete list of medical facilities provided by NHW.

The existing radio communication facilities to the remote villages is operational only 50% to 80% of the time due to ionospheric conditions and maintenance problems. The lack of reliable communications lowers the quality of medical service available to residents and increases the operational expenses of NHW. NHW recognizes the value of good communications in the northern regions as they have supported the installation of 17 Anik thin route stations by agreeing to pay an annual charge of \$250,000. Better communications would increase contact between the patient and doctor. This contact would enable the number of emergency evacuations to be reduced, thus saving transportation costs, and at the same time, reducing the unnecessary use of northern hospitals. The morale of northern staff is expected to increase considerably when reliable telephone service becomes available. This increased morale will result in lower staff turnover. (7), (8).

The NHW annual budget for medical service to those remote communities is \$45 million. If the increased contact with patients and reduced time loss for travel attributable to reliable telephone service amounted to a mere three percent improvement in the operation, the equivalent savings would be \$1,350,000 per year. This is an extremely conservative estimate of the potential benefit that would accrue from a reliable telephone service in northern communities.

NHW operates other programs in the remote regions, jointly with provincial agencies. For example, the Canada Pension Plan, and the Welfare part of NHW maintain many offices throughout Canada. These programs could benefit from better telephone service to the remote villages.

4. Petroleum Industry

The petroleum industry is operating in many areas of the north. For example, there are more than one hundred sites where bore holes are being drilled. Each of these sites has a sizeable crew, and costs thousands of dollars per day to operate.

The need for communication to drilling sites is met either by radio systems or by regular aircraft schedules. It could be of significant benefit for these oil companies to retire their private system with their operator expenses and employ a more reliable UHF multi-purpose satellite terminal on the drilling site and in Calgary.

The petroleum companies also use extensive communication systems for well control, both oil and gas. They also use communications to control the flow through pipeline systems. The communications needed for pipeline control must be designed for 99.9% reliability. If the UHF multi-purpose system could meet this requirement, there could be a very high demand.

The UHF satellite could also be employed by the petroleum industry during construction of pipeline systems or port facilities. The wide range of possible uses can only be evaluated after a detailed investigation within the industry in conjunction with the Canadian Petroleum Association.

5. Provincial Users

As has been mentioned elsewhere in this report, the provincial authorities are generally responsible for the administration of services to the people. The federal agency only gets involved for program financing. To actually determine traffic volume levels for each provincial department using communications in these small settlements requires provincial participation. Departments such as Lands and Forests, Tourism, Education and Welfare all need good communication facilities because they deal directly with their field representatives. (6), (4).

6. Other Users

Everyone in the North or remote regions of the South needs better communications than he is receiving today. Some examples of groups that have provided their own HF networks to maintain contact, that have not already been discussed:

1. Hudson Bay Company
2. Missionary Groups
3. Private air freight companies
4. Shipping companies
5. Logging companies
6. Mining companies
7. Power companies
8. Resort owners

In some small villages, there are as many as eight different organizations with their own HF radio sets. The unfortunate thing is that poor propagation conditions make them all unusable at the same time.

In a case like this, one satellite terminal could connect with the village telephone system, and the service provided would eliminate many of the problems that now exist. At the same time, more services would result in addition to better economy for the separate agencies involved.

(ii) Transportable Units

1. Ministry of Transport

Canadian Coastal Radio Telephone Service, through its coast stations, provides a public correspondence radiotelephone message and marine telephone service 24 hours daily. The user pays for this service on a per minute or per word basis. The booklet on radio telephone service released by MOT, April 1970, and revised July 1971, is sold by Information Canada, catalogue #T54-2571, (9). This booklet discusses the service provided and indicates the factors that affect communications. It states that, "under adverse conditions, it is difficult and, at times, impossible, to maintain good communication between ship and shore stations". The booklet indicates five major reasons for poor results. These conditions are:

- interference from other sources,
- sky-wave propagation interference with ground wave,
- thunderstorm activity,
- land mass interference,
- propagation characteristics change as ships approach shore.

All five of these conditions are characteristics of HF radio systems, and could be overcome by a UHF multi-purpose satellite system.

This means that a much better service could be provided by changing over to the satellite system as part of the continuing program of updating.

The Canadian Coast Guard maintains a sizeable oceangoing fleet and also a number of craft on the Great Lakes. These ships require excellent communications with their respective control headquarters so that rescue operations can be started quickly and tightly controlled. The present facilities in use could be improved, especially as the demand for assistance in the northern waters is increasing. This northern theatre of operations becomes very important as economic development increases, and questions of sovereignty arise. A good example is the second voyage of the Manhattan, accompanied by a Canadian Coast Guard vessel. A very expensive and sophisticated HF radio system was used to get reports from the tanker, whereas the Canadian craft newspaper passengers could not get their stories sent south, because the communication facilities were not good enough. Search and rescue operations at sea are under the authority of the Coast Guard, and could benefit from better communications.

2. Indian-Eskimo Affairs and Northern Development

The Federal Department of Indian Affairs and Northern Development (DIAND) maintains a force of 60 resource officers. These men have large tracts of the territories to inspect on a fixed schedule. They travel by truck, plane, boat and on foot. They have specific tasks to perform and must report to a control point. It is also important for the central control point to be able to contact the resource officers.

However, the ability to maintain contact at the present time depends on communication facilities that have limited range even under ideal conditions. The ideal conditions very seldomly exist, and the demand for reliable communications goes unsatisfied.

These resource officers would receive benefit from a transportable UHF multi-purpose satellite system. They could maintain excellent telephone quality communications using a battery operated set.

Better communications would enable DIAND to utilize the limited supply of men and machines more effectively. Often a resource officer is out of range for his radio and loses contact with his control point for hours or days at a time. This situation is also a safety factor in the event that the officer became injured while out of touch with home. The poor radio propagation conditions often render equipment useless, sometimes for a week at a time.

These resource officers are constantly alert for signs of forest fire. If a fire can be detected and reported during the first few hours or days of its birth, the damage is less than if the fire were undetected for several days.

3. Energy, Mines and Resources (EMR)

EMR sends out 260 field parties every summer for varying periods of time. Of these 260, about 140, or more than half in any given year, are in remote regions of Canada and could use a transportable facility to replace the HF radio now in use. The HF radio set is used to contact a local village

at least once a day. The satellite facility would permit the field party to contact headquarters in Ottawa for the transmission of administrative messages and the delivery from the field of experimental data to the computer centre. This communication link would enable the members of the field party to contact home and be reached by family at home in case of emergency or for maintaining family unity while one member is on a lengthy stay away from home.

There are many benefits that would be realized from such a system. It is necessary to point out only a few in order to realize the potential improvement in the ability of EMR to carry out its tasks.

Maintaining personnel in the field, including all the associated logistics costs such as travel, hotels, food, aircraft charter, local help, etc. is expensive. Typical cost for a field mapping party in Northern Labrador is about \$122 per man-day. The total cost for this team of seven came to \$66,000 for 2 months. A four man geological mapping crew in Yellowknife area had a daily operating cost per man of \$73. The opportunity to improve effectiveness or reduce time delays by utilization of satellite communications is good news to all the different branches of EMR that send field parties into remote regions.

In addition to the requirements during the summer, EMR has a similar need for transportable communication sets during the winter months. The winter needs would be roughly 30-40 parties. An additional benefit that would be even more important during the cold winter months is the comfort of knowing that help is only as far away as the phone.

4. Royal Canadian Mounted Police (RCMP)

The RCMP maintains about 200 sets of transportable HF radio equipment for use during operations away from base. They also maintain a very extensive network of fixed HF radios. Therefore, their transportable unit provides relatively good service.

However, as costs of manpower increase, the RCMP will find the cost of maintaining such a large force of radio operations very expensive. Then, the UHF concept will permit private telephone service to all villages and the transportable units will permit easy access to the telephone network. The increased dependability and improved quality will permit the RCMP to modernize its operation by using up to date data transmission facilities from the remote regions into the national network.

RCMP benefit from using this transportable facility would be important for their role in the North. The availability of transportable communications will become increasingly more important as the tourist population in remote regions increases. There will be more search parties required and more forest fire fighting units to co-ordinate. Therefore, the RCMP will need more reliable transportable communications than they use at this time.

5. Petroleum Industry

In 1969-1970, there were about 100 survey parties in the field during the winter, with about fifty in the summer. It could be assumed that the demand for transportable communications sets would be one for each field party.

A potential benefit from using a UHF transportable unit would be increased productivity of each field party. The collected data could be relayed to a computing centre as it became available and the completed analysis could be sent back to the field party. Even this simple procedure would eliminate idle waiting time. Call-backs could be eliminated or reduced because the data originally collected could be tested before the field party departed from a test site, and any additional measurements could be made immediately.

The reliability of communications could be improved at least 20%, since the reliability presently experienced ranges from 50% to 80%. In addition to days of impossible communications, there are frequently periods throughout the day, when contact with HF equipment cannot be used because of interference. This UHF system would be designed for operational reliability of 99.9%. The petroleum industry is very interested in pursuing the capability for sending data on this system, especially from the field.

The field personnel could easily use a transportable set, connected to the national telephone network to make calls home. While on a field trip, the two or three weeks away can seem very long. In the south, the federal government pays for one call per week when personnel are on temporary duty away from home. Private corporations no doubt have a similar policy. It would seem reasonable to assume that consideration would be extended to both private and public employees in the remote parts of Canada.

6. Provincial Users

Even though the provincial authorities have not been contacted for this preliminary evaluation, it is necessary to point out that the

provincial departments have a definite need for good transportable communications. This need may, like the federal need, disappear somewhat as permanent telephone service is installed in every village in Canada. In the meantime, a provincial study would yield an indication of present and future demand for this type of service.

7. Other Users

In the Canadian north, many different organizations maintain data collection stations. These stations are remote controlled devices that can operate without servicing for a period up to six months. They collect data on a fixed schedule or at the command of a control centre and periodically relay this data to a central receiving station via a satellite. This type of data platform can operate with the UHF satellite.

However, when the time comes to repair these devices, a crew has to travel by helicopter or overland to the remote location. During this operation, a transportable unit that operates via the same UHF satellite would be invaluable for adjusting, calibrating and testing these data collection devices. The transportable set would also improve the speed of the maintenance operation as well as improve the safety aspect of the operation. (3)

(iii) Radio Broadcasting

1. The Canadian Broadcasting Corporation (CBC)

One meeting was held with CBC representatives. The outcome was a statement that if the price was right, the CBC could foresee a use for two radio channels and possibly a third.

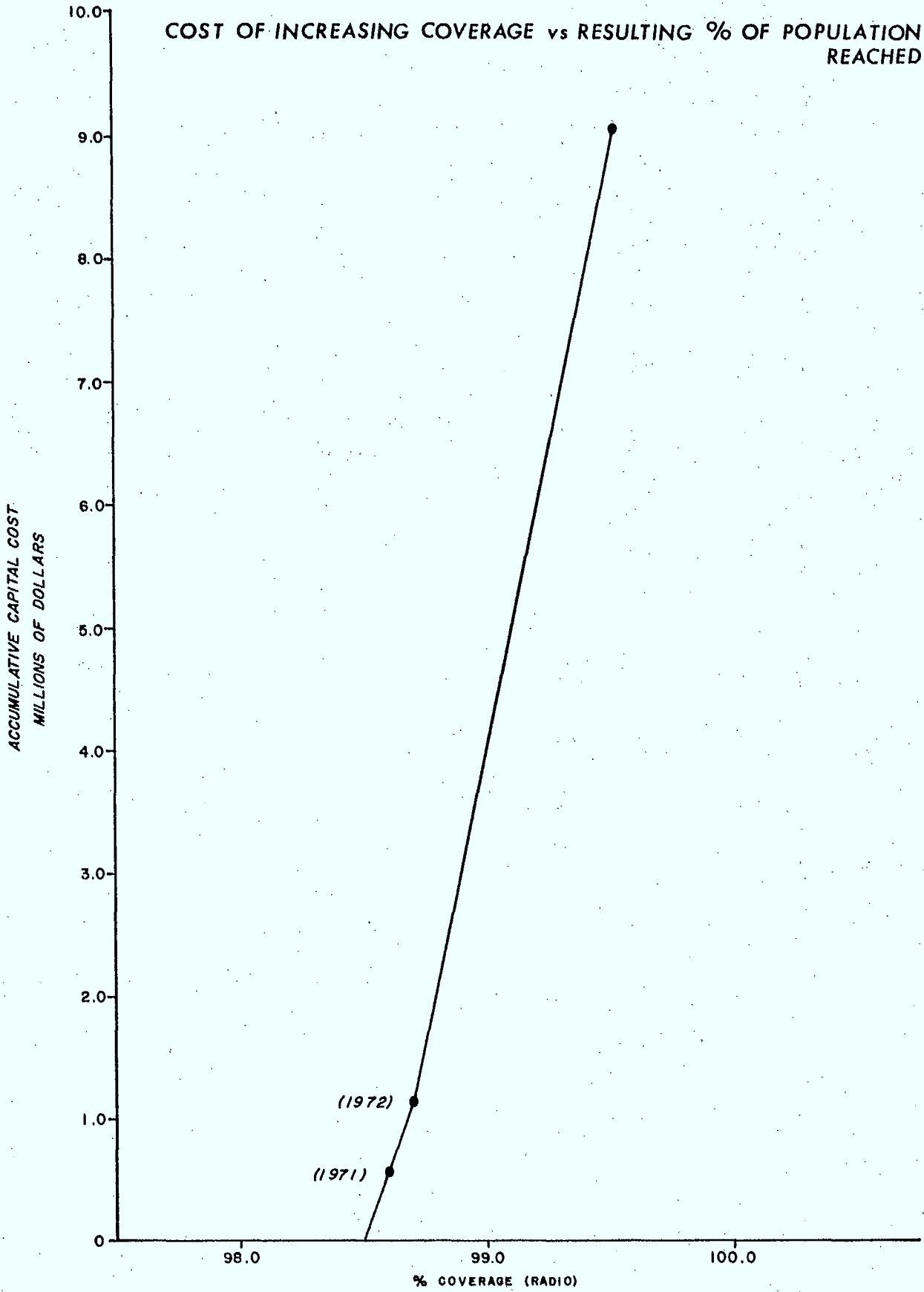
To evaluate the potential benefit entailed, a description of the CBC mandate "to develop and to provide a national broadcasting service for all Canadians in both official languages, in television and radio, and an international service, both of which should be primarily Canadian in content and character".

To measure the benefit of using the proposed UHF satellite to carry radio broadcasts to remote parts of Canada entailed finding the marginal cost of extending coverage using conventional methods. Data from the Estimates publication and data from the CBC internal statistics department produced the points for the graph in Figure 1. This figure represents capital cost and not operating costs. (10, 11, 12, 13).

With the knowledge that the last two percent of the population yet to be reached is situated in the places that are hardest to service, the law of diminishing returns comes into play. From Figure 1, it is clear that \$8.5 million will extend the combined English and French radio coverage to 99.5% of the population. This coverage is extended for example to very few communities with populations less than 500 people. The additional communities that radio coverage is planned for are 36 French and 84 English communities with populations down to 500.

With the UHF multi-purpose satellite system operational any community that had the basic telephone package, for an additional \$2,000 could buy a radio pickup. An estimated \$8,000 would be needed to purchase and install a Low Power Radio Transmitter. (16) Thus, 250 communities with populations down to 50 persons could be provided with radio for \$2.5

COST OF INCREASING COVERAGE vs RESULTING % OF POPULATION REACHED



million. This is less than 1/3 of the \$8.5 M needed to serve only half the number of communities by conventional methods.

It will be necessary to compare O/M figures for both proposals in detail, but this can only be carried out by the CBC in concert with the satellite authorities.

4. CONCLUSIONS

This study was undertaken to provide an initial assessment of potential use and benefits that would result if a UHF multi-purpose communications satellite were put into operation. The conclusions of the study are therefore statements of scope of the requirements, potential use of the proposed system, and interest of potential users. Actual use will depend on considerations of facilities offered, capacity and timing of the system.

The potential use as indicated in Tables III (a) and III (b) suggests that the fixed, transportable and marine applications would be heavily utilized, and should be included in the final satellite design.

The present volume of independent HF radio networks maintained by federal, provincial and private individuals indicates the need for a reliable communication system for the remote regions of Canada. Because these are not integrated, a situation has developed whereby some redundancy exists. There is no doubt that the UHF satellite concept will provide more reliable communications with consistently high quality. Although at this time, it is impossible to support cost estimates, it seems likely that a consolidated system, operating continuously, would be more economical than existing systems.

Detailed information will have to be provided for potential users before commitment can be expected from them concerning their actual use. Most users contacted showed interest in the possibility of good, reliable communications in the remote areas and would be prepared to

carry out analysis of their operations to define potential use and benefits so that the operating agency could make more accurate revenue predictions.

The following lists in summary form some of the principal benefits envisioned from introduction of the satellite system.

1. Improved ATC communications at private and MOT airports.
2. Better beacon signals for flying aircraft navigation.
3. Improved, more up to date weather data.
4. Improved lighthouse control at lower operating costs.
5. Improved service to northern residents when shipping goods.
6. Improved IAND control over projects in North.
7. Improved operating of National Parks.
8. Reduced overhead communication costs for northern companies.
9. Consolidated northern communication network.
10. Flexible communications for new areas under development.
11. Improved office operations with use of facsimile copiers.
12. Reduced travel costs and associated time wasted on the road.
13. Improved reliability of communications would reduce number of emergency evacuations and reduce the needless use of hospital facilities.
14. Improved medical service with better contact between doctor and patient.
15. Improved morale of northern medical staff with reduced staff turnover.
16. Reduced travel costs for medical staff.

17. Better control of Welfare programs in the remote regions.
18. Reduced communication costs and improved control over operations for petroleum companies.
19. Potential use for gas pipeline control.
20. Reliable communications for industry on a temporary basis during the construction phase of northern operations.
21. Improved communications for provincial operations.
22. Reduction of duplication in communications equipment in small villages.
23. Hopefully, better maintenance care if all users had the same type of equipment, so that maintenance crews could become proficient in repairing the equipment.
24. Improved commercial ship to shore and shore to ship telephone service. Also improved coverage over a larger section of the ocean.
25. Improved Coast Guard operation with better communications.
26. Better communications for IAND resource offices which improves operation as well as safety.
27. Improved forest fire control.
28. Improved operation for field survey mapping parties and geological survey crews. Reduced number of call-backs for additional data collection.
29. Field parties could reach the National Telephone network using a transportable terminal.
30. Reduced field party costs since waiting time could be reduced.
31. Improved factor of safety from more reliable communications.
32. Reduced operation and maintenance costs for the RCMP radio network by replacing it with a telephone network via satellite.

33. RCMP operations will benefit from modernized communication facilities in remote regions.
34. Increased control over search parties when equipped with transportable telephone sets.
35. Increased productivity of petroleum and mining company survey crews.
36. Collection of timely data from remote unmanned data sensors at a reasonable cost.
37. Communications for mobile maintenance crews in remote regions for calibrating and testing field monitors.
38. Reduced radio broadcasting costs in remote areas.
39. Improved contact between remote communities with reliable telephone service.
40. Better HF radio propagation as the number of HF radio sets is reduced.
41. Introduction of reliable telephone service between the northern and southern residents of Canada.

In conclusion, the extent of potential benefits available through introduction of the satellite system appears to be substantial.

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APPENDIX I

Technical Description of UHF Satellite

Communications System

Service Capabilities of a Multi-Purpose UHF
Satellite Communications System for Use With Small Terminals

The UHF satellite communications system which has been modelled by the Department of Communications is intended to meet a variety of communications needs in remote areas of Canada. The needs are all of a low capacity, typically a telephone voice channel or less and are geographically widely dispersed. The system has been designed so that the ground terminals are small in size (less than 6 feet in diameter) and comparatively low in cost to permit their wide deployment.

The specific services which the system could provide are:

- telephone and message service to fixed stations in remote communities
- radio program distribution for rebroadcasting in remote communities
- telephone and data service to transportable stations used by field parties
- voice and data service to mobile stations on ships
- voice and data service to Canadian armed forces aircraft
- data transmission service from remote environmental sensor platforms
- monitoring service for emergency position indicating radio beacons

These services are described in more detail in the paragraphs which follow.

Fixed Community Stations These stations would provide the long-distance interconnection between remote communities which are presently served by high frequency radio, with the major difference being that quality and reliability would be similar to the telephone service available in southern Canada. Communications between remote communities and between these communities and the national telephone network would be possible. The entire range of services normally available via telephone systems, including message, data, and facsimile could be available wherever a station existed. For communities with local telephone networks, the station would be integrated with the network and would be available from any telephone. Use of the service available from the station would be subject to charges in the same manner as long distance services.

Radio Program Distribution Several channels could be made available for distribution of radio programs for local rebroadcasting so that they could be received with normal home receivers. The receiving stations in the community for the satellite radio channels could be most economically provided as a module (estimated to cost less than \$2000) in the fixed telephone station. Otherwise, off-the-shelf equipment suitable for receiving is known to be available for less than \$8000.

A feature possible with the system is that programs can be originated from the remote areas either via a transportable station or via a suitably modified fixed telephone station.

Transportable Stations These are stations which are designed to be easily moved and placed into operation within minutes by persons with a minimum of training. The antenna would typically be a tripod mounted helix and the electronics package would be about one cubic foot in size. Quality of service would be somewhat lower than good telephone quality, but should nevertheless prove very satisfactory. Reliability would be at least 99%.

Transportable stations would find civilian application for field parties engaged in surveying and resources exploration, law enforcement, disaster control, (such as control of forest fire fighting resources), installation of equipment in remote areas, construction, and any other temporary activity in the north.

Mobile Stations Ship mobile stations would be similar to the transportable stations, with antenna repointing required for changes in direction greater than about 20 degrees. Aircraft mobile stations would use omnidirectional antennas, with no gain. Since this places a heavy drain on the satellite resources, only one or two channels can be provided for this service. In addition to being of limited availability, it would also be expensive and is not considered suitable for domestic aircraft.

Data Transmission Service from Remote Sensors This service is similar to that being tested experimentally in 1974 with the GOES satellite. Small, low cost (less than \$5000) transmitters can be used to transmit the small amounts of data collected by remote sensors making hydrologic, meteorologic, and other similar measurements. These data could be centrally collected, automatically processed, and made available to users computers in near real-time. This is in contrast to present methods where, because of lack of suitable communications, data is usually recorded, manually retrieved, and hand processed for entry into computers, with delays of one to two months. Real time availability makes possible productive new applications of the data. For some sensors, such as those used for weather and flood forecasting, real-time data is essential and is presently provided by costly conventional communications methods.

Emergency Beacon Monitoring Since a geostationary satellite can be "seen" for 24 hours a day from all but the extreme northern tip of the Arctic Islands, it is an ideal way of monitoring for signals from emergency position indicating radio beacons. A special frequency allocation for such a service was made at the 1971 World Administrative Radio Conference, and suitable beacon transmitters for use with aircraft, boats, or even land parties are under active development in the United States. Since Canada has a vast remote area, such a service would be of great importance.

The first part of the report deals with the general situation of the country and the progress of the work during the year. It is followed by a detailed account of the various projects and the results achieved.

The second part of the report deals with the financial aspects of the work. It gives a detailed account of the income and expenditure of the organization and shows that the work has been carried out within the budget.

The third part of the report deals with the personnel of the organization. It gives a detailed account of the staff and shows that the work has been carried out by a highly qualified and experienced staff.

The fourth part of the report deals with the future prospects of the organization. It gives a detailed account of the plans for the next year and shows that the organization is well placed to continue its work in the future.

The fifth part of the report deals with the general conclusions of the work. It shows that the organization has made significant progress during the year and that the work has been carried out in a highly efficient and economical manner. It also shows that the organization is well placed to continue its work in the future.

The sixth part of the report deals with the general conclusions of the work. It shows that the organization has made significant progress during the year and that the work has been carried out in a highly efficient and economical manner. It also shows that the organization is well placed to continue its work in the future.

Ministry of Transport Communications (HF Radio)

There are two parts to the information presented in this appendix concerning the communications of the Ministry of Transport. Both parts have been reproduced from a survey completed by the Government Telecommunications Agency (1970).

The data in part one indicate the present system size and operating costs. Projections are made based on expected growth through 1975, D of MOT. This growth does not reflect any stimulation effect caused by improved communication developments. The table doesn't reflect the cost of salaries or building accommodation.

The second part demonstrates the range of radio systems the MOT uses and maintains for other departments and agencies. For example: #7 is a commercial network, #17 is for lighthouse use, #18 is for private users who pay MOT for its use, #24 is for weather data, and so on throughout the table.

MOT HF RADIO NETWORK

Summary and Projection

<u>Year</u>	<u>No. of Systems</u>	<u>No. of Stations</u>	<u>Misc.Op. Costs</u>	<u>Eq. Lease</u>	<u>Maint. Costs</u>	<u>Total Recurring</u>
1970	86	321	8256.	8371.	23031.	39658.
1971	92	355	8600.	8955.	24610.	42165.
1972	98	379	8900.	9581.	26330.	44811.
1973	105	405	9200.	10251.	28170.	47621.
1974	112	433	9500.	10968.	30140.	50608.
1975	120	463	9800.	11735.	33240.	53775.

Source: MOT response to GTA Questionnaire 1970.

<u>No.</u>	<u>Location</u>	<u>No. and Type</u>	<u>Monthly Cost</u>	<u>Use</u>
1.	BC	1 Fixed V&D	30.00	VOR
2.	BC	1 Fixed V&D	30.00	VOR
3.	BC	1 Fixed V&D	20.00	VOR
4.	BC	1 Fixed Data	20.00	ICS
5.	BC	5 Fixed Voice	30.00	Airops B/U
6.	BC	4 Fixed Voice	25.00	Airops
7.	BC	3 Fixed Voice	20.00	Commercial
8.	BC	11 Fixed Voice	60.00	Lighthouse
9.	BC	7 Fixed Voice	40.00	Lighthouse
10.	BC	8 Fixed Voice	45.00	Lighthouse
11.	BC	5 Fixed Voice	30.00	Lighthouse
12.	BC	1 Fixed Voice	10.00	11 private
13.	BC	5 Fixed Voice	20.00	Lighthouse
14.	BC	2 Fixed Voice	20.00	Lighthouse
15.	BC	1 Fixed Voice	10.00	6 private
16.	BC	1 Fixed Voice	10.00	40 private
17.	BC	2 Fixed Voice	20.00	Lighthouse
18.	BC	1 Fixed Voice	10.00	42 private.
19.	BC	3 Fixed Voice	20.00	Met traffic
20.	BC	1 Fixed Voice	10.00	20 private
21.	BC	1 Fixed Voice	60.00	10 private
22.	BC	3 Fixed Voice	20.00	Lighthouse
23.	BC	2 Fixed Voice	15.00	Met data
24.	BC	2 Fixed Voice	10.00	Met data
25.	BC	2 Fixed Voice	10.00	Met data

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<u>No.</u>	<u>Location</u>	<u>No. and Type</u>	<u>Monthly Cost</u>	<u>Use</u>
26.	BC	2 Fixed Voice	10.00	Met. data
27.	BC	2 Fixed Voice	8.00	Maintenance
28.	BC	2 Fixed Voice	8.00	Maintenance
29.	NWT	2 Fixed Voice	100.00	Admin.
30.	NWT	2 Fixed Voice	135.00	Met. data
31.	NWT	2 Fixed Voice	135.00	Airops
32.	NWT	2 Fixed Voice	135.00	Backup
33.	NWT	2 Fixed Voice	325.00	Airops
34.	Alta, NWT	2 Fixed Voice	900.00	Met. facsimile
35.	Alta, NWT	2 Fixed Voice	10.00	Met. facsimile
36.	BC, Alta, Sask.	6 Fixed Voice	250.00	Backup
37.	Alta, NWT	6 Fixed Voice	275.00	Backup
38.	BC, Yukon	7 Fixed Voice	325.00	Backup
39.	NWT	9 Fixed Voice	425.00	Backup
40.	Yukon	2 Fixed Voice	15.00	Maintenance
41.	Man, Que, NWT.	6 Fixed Data	3306.00	Airops
42.	SASK.	2 Fixed V&D	200.00	VOR
43.	NWT	5 Fixed Data	4281.00	Admin.
44.	NWT	2 Fixed Voice	200.00	Met.
45.	Man, Quebec	4 Fixed Voice	800.00	Airops
46.	NWT	6 Fixed Voice	2000.00	Admin.
47.	Man.	3 Fixed Voice	1800.00	Admin.
48.	NWT	5 Fixed Voice	2200.00	Backup
49.	Sask.	2 Fixed Voice	1200.00	Met
50.	ONT.	2 Fixed Voice	1000.00	Met.

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APPENDIX II

Page 4

<u>No.</u>	<u>Location</u>	<u>No. and Type</u>	<u>Monthly Cost</u>	<u>Use</u>
51.	NWT	2 Fixed Data	1113.00	Airops
52.	Sask.	2 Fixed Voice	1000.00	Met.
53.	Ont.	2 Fixed Data	2500.00	Radar
54.	Ont.	9 Fixed Voice	900.00	Backup
55.	Ont.	2 Fixed V&D	1200.00	NAB
56.	Man., Que., NWT	5 Fixed Data	1029.00	Airops
57.	Quebec	6 Fixed Data	1229.50	Airops
58.	Quebec, NWT	2 Fixed Data	195.00	Admin.
59.	Quebec	3 Fixed Data	307.00	Admin.
60.	Quebec, NFLD	4 Fixed Data	20.00	Maint.
61.	Quebec, NS, NFLD	3 Fixed Voice	15.00	Maint.
62.	NS., NFLD.	5 Fixed Voice	25.00	Main.
63.	NS	10 Fixed Voice	60.00	Lighthouse
64.	NS	8 Fixed Voice	40.00	Lighthouse
65.	NS.	5 Fixed Voice	25.00	Lighthouse
66.	Quebec, NS.	3 Fixed Voice	15.00	Lighthouse
67.	NS., P.E.I.	3 Fixed Voice	15.00	Lighthouse
68.	N.B., N.S.	9 Fixed Voice	45.00	Lighthouse
69.	N.S.	4 Fixed Voice	30.00	Lighthouse
70.	NFLD	5 Fixed Voice	45.00	Lighthouse
71.	NFLD	6 Fixed Voice	30.00	Lighthouse
72.	NFLD	3 Fixed Voice	15.00	Lighthouse
73.	NFLD	13 Fixed Voice	65.00	Lighthouse
74.	NFLD	4 Fixed Voice	20.00	Lighthouse
75.	N.S.	3 Fixed Voice	15.00	Nav. Info.

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<u>No.</u>	<u>Location</u>	<u>No. and Type</u>	<u>Monthly Cost</u>	<u>Use</u>
76.	NFLD	2 Fixed Voice	10.00	Nav. Info.
77.	NFLD, NWT	2 Fixed Voice	320.00	Admin.
78.	N.S.	6 Fixed Voice	30.00	Lighthouse
79.	N.S.	6 Fixed Voice	220.00	Admin.
80.	Ont.	2 Fixed Voice	20.00	Lighthouse
81.	Ont.	2 Fixed Voice	20.00	Lighthouse
82.	Ont.	2 Fixed V&D	20.00	Lighthouse
83.	N.S.	2 Fixed V&D	20.00	Foghom
84.	N.B.	2 Fixed V&D	96.00	Lighthouse
85.	BC	4 Fixed Data	110.00	Foghom
86.	Quebec	9 Fixed Voice	8371.00	Marine traffic

Source: MOT response to GTA questionnaire 1971.

APPENDIX III Indian and Eskimo Affairs and
Northern Development Communications

Indian and Eskimo Affairs and Northern Development Communications

This list of radio systems is reproduced from the IAND response to the 1970 Government Telecommunications Agency Survey. The table indicates the four main uses for IAND HF radio systems: Indian reserves network, fishing network, fire control, and national parks management.

The list indicates the location of the network, what type of equipment (fixed, mobile or transportable) is used and the monthly cost (maintenance and rental) without the cost of operators or building expenses.

IAND estimates are made for 1975 requirements in new national parks.

DEPARTMENT OF INDIAN-ESKIMO AFFAIRS AND NORTHERN DEVELOPMENT

HF RADIO SYSTEMS

<u>No.</u>	<u>Location</u>	<u>Fixed</u>	<u>Mobile</u>	<u>Trans- portable</u>	<u>Monthly Cost</u>
1	Indian Reserves			5	100.
2	Indian Reserves (Ontario)	5			50.
3	Manitoba Fishing Station	12	8		200.
4	Alberta			1	15.
5	B.C. Fire Control	2	4	3	10.
6	Cape Breton Highland National Park (N.S.)	13	18	8	500.
7	Fundy National Park (N.B.)	10	14	4	-
8	Ketimkujic National Park (N.S.)	1	7	11	-
9	P.E.I. National Park	8	6	4	-
10	Terra Nova National Park (Nfld)	3	14	8	-
11	Ontario National Park	2	6	4	65.
12	Banff National Park	16	40	38	400.
13	Elk Island National Park (Alberta)	6	9	4	100.
14	Jasper (Alberta)	23	33	30	300.
15	Kostenay National Park (B.C.)	8	13	9	150.
16	Mount Revelstoke and Glacier National Park	10	26	17	715.
17	Prince Albert National Park (Saskatchewan)	14	20	15	200.
18	Riding Mountain National Park (Manitoba)	17	25	22	190.
19	Waterloo Lakes National Parks (Alberta)	5	14	9	100.
20	Wood Buffalo National Park (N.W.T.)	14	8	11	200.
21	Yoko National Park (B.C.)	8	22	14	180.
22	Forest Fire Control (Yukon)	37	44	76	800.
	TOTALS FOR 1970	214	331	293	4,195.
	Add For New National Parks	8	52	68	
	TOTALS FOR 1975	222	383	361	

APPENDIX IV National Health and Welfare Submission

NHW Potential Uses and Benefits

from

UHF Multi-Purpose Satellite Communication

This submission has been prepared by Medical Services, Department of National Health and Welfare at the request of the Space Systems Planning Branch of the Department of Communications.

The submission has been prepared with the understanding that much of the information supplied is purely the result of estimates and can in no way be considered as firm commitments. The reason for this initial estimate is that DOC required an example of an analysis of potential use and benefits, so that a formal request for information might be more productive.

Medical Services Branch operates a Northern Health Services program which provides a total medical service to all residents of the two Territories and an Indian Health program which provides a health service to the majority of Indians in the provinces.

For the purpose of administering the health services program, the country has been divided into eight Regions generally on the lines of provincial boundaries, and are as follows:

<u>Region</u>	<u>Zones</u>
Atlantic	Moncton Halifax
Quebec	Quebec North Montréal Quebec South
Ontario	Sioux Lookout Thunder Bay Moose Factory Southern Ontario
Manitoba	Manitoba North Manitoba South
Saskatchewan	Northern Fort Qu'Appelle North Battleford
Alberta	no Zones
Pacific	Northwestern Northeastern South Mainland Vancouver Island

Northern

Baffin
Inuvik
MacKenzie
Keewatin
Yukon

A complete listing of the facilities in each Region and Zone is in Appendix A attached--"Indian and Northern Health Services Facilities Listing".

The total cost of the programme is about \$45 million--there is a simple breakdown included for the purpose of illustration in Appendix B--"Northern Health Services, Sample Budget".

The program maintains six different types of medical facilities:

1. Hospital
2. Clinic
3. Nursing Station
4. Health Centre
5. Health Station
6. Health Office.

A definition of each of these terms can be found in Appendix C--"Medical Services Terminology".

The Branch has professionally trained staff at the hospitals, clinics, nursing stations and health centres, and at the health stations a Community Aide with limited training is usually employed on a part time basis. Physicians visit all facilities where nurses are employed and physicians and nurses visit all communities that come under the jurisdiction of the facilities.

Since scheduled flights are infrequent to and from the isolated communities in the North, it is often necessary to charter aircraft and due to the high cost of these charters and the degree of urgency usually associated with the chartering of aircraft, a reliable system of communication is vitally necessary.

At the present time the communications are of poor quality, except in areas where upgrading has taken place recently. Even the new radio equipment suffers from periods of poor transmission. This can result in radio contact possible between 50% and 80% of the time. Often when contact is possible the reception is poor. The radio sets do not permit good quality data transmission on a reliable basis, although some sophisticated sets do at the present time pass graphical data.

Presently the Health Services program maintains dedicated radio networks of their own, consisting of 55 stations. These are Sioux Lookout Zone and Northern Manitoba. The quality is rated by NH&W as good, which means contact can be made about 75% of the time. These systems cost a total of \$5,640 per year for equipment lease. In addition there are 6 operators on annual salaries totalling \$30,000.

It is anticipated that there would be an increase in the number of calls made if the system was satisfactory and enabled calls to be made from station to station, and could be as much as 10%. This has been proven in the past where new and more efficient systems have been installed, particularly if the system is more economical.

In the remaining areas where Health Services maintain establishments, telephone service is provided by commercial carriers, either by landline, microwave system or some type of radio telephone system. 20% of these locations are serviced by radio telephone. According to a survey made by the Communications Research Centre the level of service provided is terrible. On the average, 50% of the calls attempted could not be completed either because contact was not possible or the quality was unacceptable.

In these areas, as well as the areas where poor quality landline service is provided, annual costs for service are \$880 on average.

The number of calls could be expected to increase by a factor of 0 to 10% if good quality, reliable and economical service were provided.

This increased telephone contact would enable the medical staff to provide increased medical health service delivery. One could estimate the increased benefit by assuming that more ailments could be treated locally and more medication dispensed. At the same time patient contact with the doctor could increase by use of the telephone.

The foregoing is related to potential use and benefits of telephone and radio communication, and a further question is what about television for telemedicine or staff training and diagnosis?

As no estimate of costs are available at this time, it is difficult to estimate to what extent this type of communication would be used. It is expected, however, that advantage would be taken of any means of communication that becomes available if it is economically feasible and the quality of transmissions are satisfactory.

With the ability to contact Toronto from the Fox Lake nursing station, training tapes or programs from the medical school could be used. This benefit could be measured in terms of possible decreased staff turnover or in increased hours of training.

ATLANTIC REGION

NOVA SCOTIA

Clinics	Halifax
Health Centres	Eskasoni Shubenacadie
Health Offices	Middle River Whycocomagh
Community Health Workers	1 (Eskasoni)
Community Aides	Nil

NEW BRUNSWICK

Clinics	Saint John
Health Centres	Big Cove Chatham Kingsclear
Health Offices	Burnt Church Kingsclear
Community Health Workers	2 (Big Cove & Burnt Church)
Community Aides	Nil

QUEBEC REGIONNursing Stations

Great Whale
Inoucdjovac
Paint Hills
Povungnituk
Rupert's House
Romaine
Sugluk

Health Centres

Amos
Birsimis
Caughnawaga
Eastmain 1973/4
Fort George
Ivujivik 1973/4
Manowan
Mistassini
Obedjiwan
Point Bleue
Restigouche
Sanmaur
Schefferville

Health Stations

Eastmain H/C 1973/4
Ivujivik 1973/4
Lac Simon
Mingan H/C 1973/4
Rapid Lake
Winneway

Community Health Workers

Rupert's House

Community Aides

Fort George
Paint Hills

Zones

South
North
Montreal

ONTARIO REGIONSioux Lookout Zone

<u>Hospitals</u>	Sioux Lookout
<u>Clinics</u>	Sioux Lookout
<u>Nursing Stations</u>	Big Trout Lake Lansdowne House New Osnaburgh Pikangikum Round Lake Sandy Lake Fort Hope
<u>Health Centres</u>	
<u>Other Stations</u>	Fort Hope H/S Lac Seul H/S North Spirit Lake H/S Pickle Lake H/S Webique H/S
<u>Community Health Workers</u>	Big Trout Lake Sandy Lake
<u>Community Aides</u>	Angling Lake Bearskin Cat Lake Fort Severn Kasabonica Ogoki Whitedog Wunnum

Thunder Bay Zone

(April 1, 1970)

<u>Clinics</u>	Manitowaning
<u>Nursing Stations</u>	
<u>Health Centres</u>	Fort Frances Geraldton Kenora Little Current Port Arthur Sault Ste Marie Sudbury

ONTARIO REGIONThunder Bay Zone (con't)Other Stations

Gull Bay
Pic Heron (1970)

Community Health Workers

Couchiching (Fort Frances)
Fort Frances
Manitowaning

Community Aides

Blind River
Lac La Croix
Longlac
Mattagami
Mountbatten
Pic Mobert
Shoal Lake
Whitefish Bay

Moose Factory ZoneHospitals

Moose Factory

Clinics

James Bay

Health Centres

Fort Albany

Other Stations

Kashechewan
Winisk

Community Health WorkersCommunity Aides

Winisk

Southern Ontario ZoneClinics

Ohswéken

Health Centres

Chipawa Hills
Muncey
Orillia
Parry Sound
St. Regis

Other Stations

Christian Island H/S
Kettle Point H/S9
Walpole Island H/S

Community Health WorkersCommunity Aides

MANITOBA REGION

MEDICAL SERVICES FACILITIES

Manitoba NorthHospital

Norway House

Nursing Stations

Brochet
 Cross Lake
 Garden Hill
 God's Lake Narrows
 Nelson House
 Oxford House
 Poplar River
 Pukatawagan
 St. Therese Point
 Shamattawa
 Split Lake
 South Indian Lake

Health Centres

Norway House
 The Pas

Health Stations

God's River
 Red Sucker Lake
 Wassagamach
 York Landing

Health Offices

Guy School. Guy Hill.

Community Health Workers

Cross Lake (2)
 Garden Hill (2)
 God's Lake Narrows
 Nelson House
 Norway House (2)
 Oxford House
 Poplar River
 Pukatawagan
 St. Therese Point
 Split Lake
 South Indian Lake
 The Pas
 Wassagamach

Community Aides

Brochet
 God's River
 Granville Lake
 Red Sucker Lake
 Wassagamach
 York Landing

MANITOBA REGION

MEDICAL SERVICES FACILITIES

Manitoba SouthHospital

Fisher River

Nursing Stations

Little Grand Rapids

Health Centres

Berens River
 Blookvein
 Brandon
 Dauphin
 Fisher River
 Lake Manitoba
 Little Saskatchewan
 Portage La Prairie
 Pine Falls
 Russell
 Sandy Bay
 Winnipeg

Health Stations

Fairford
 Jackhead
 Paungassi
 Rolling River
 Roseau River
 Sioux Village
 Swan Lake

Health Offices

Birdtail Sioux
 Crane River
 Dog Creek (Lake Manitoba)
 Ebb & Flow
 Fisher River School
 Hollow Water
 Keeseekoowenin
 Lake St. Martin
 Little Black River
 Long Plain
 McKay Student Residence (Dauphin)
 Oak Lake
 Oo-Za-We-Kun (Rivers)
 Sioux Valley
 Valley River
 Waterien
 Waywayseecappo

Manitoba South (cont'd)

Community Health
Workers

Berens River
Ebb & Flow
Fisher River
Jackhead
Little Grand Rapids
Little Saskatchewan
Pine Falls
Roseau River
Sioux Valley
Swan Lake
Waterhen
Waywayseecappo

Community Aides

Bloodvein
Crane River
Fairford
Hollow Water
Jackhead
Keeseekoowenin
Paungassi
Waterhen

SASKATCHEWAN REGION

MEDICAL SERVICES FACILITIES

Hospitals

Fort Qu'Appelle
North Battleford

N/S

Pewcan Narrows

Health Centres

Broadview
Fort Qu'Appelle
Kamsack
La Ronge
Meadown Lake
North Battleford
Onion Lake
Prince Albert
Stony Rapids

Health Stations

Beardys
Beaver Lake (P. Ballantyne)
Big River (2)
Black Lake (Stony Rapids)
Canoe Lake
Carry the Kettle
Daystar
Deshambault (P. Ballantyne)
Fishing Lake
Fond du Lac
Gordon's
James Smith
Joseph Bighead
Kakhewistahaw
Keeseekoos
Key
Kinistino (Chagoness)
Kitsaki (La Ronge)
La Loche
Little Black Bear
Little Pine and Luckyman
Little Red River
Loon Lake
Mistawasis
Montreal Lake
Moosomin
Mosquito
Mudie Lake
Muscowpetung
Muskowekwan
Musmeg Lake

Health Stations (cont'd)

Nut Lake
Ochapawace
Okanese
One Arrow
Onion Lake
Pasqua
Patvanak
Pelican Lake
Piapot
Poorman
Poundmaker
Red Earth
Red Pheasant
Sakimay
Sandy Lake
Southend Reindeer (P. Ballantyne)
Stanley Mission
Standing Buffalo
Star Blanket
Sturgeon Lake
Sturgeon Landing (P. Ballantyne)
Sweetgrass
Thunder Child
Waterhen
Whitebear
Wollaston Lake (Lac La Hache)

Health Offices

Cote
Cowessess
Dillon (Peter Pond)
John Smith (Muskoday)
Peepokeesis
Witchehan

Community Health
Workers

Prince Albert
Gordon's
James Smith (T)
La Ronge
Mistawasis (T)
Mosquito
Muscontetung
Muskeg Lake (T)
Onion Lake
Pelican Narrows
Piapot
Red Earth
Sakimay
Shoal Lake
Thunder Child
Whitebear

Community Aides

Beardys
Fond du Lac
James Smith
Co-op Point
Stanley Mission
Mistawasis
Montreal Lake
Muskeg Lake
One Arrow
Deschambault
Southend Reindeer
Sturgeon Landing
Red Earth

ALBERTA REGION

MEDICAL SERVICES FACILITIES

<u>Hospitals</u>	Blackfoot	
	Blood	
	Charles Camsell	
<u>Nursing Stations</u>	Assumption	
	Fort Chipewyan	
	Fox Lake	
<u>Health Centres</u>	Bonnyville	
	Calgary	
	Cardston	
	Driftpile	
	Edmonton	
	Gleichen	
	Goodfish Lake	
	Hobbema	
	John D'or	
	Peigan	
	Rocky Mountain House	
	Saddle Lake	
	Sturgeon Lake	
<u>Health Stations</u>	Alexander	
	Alexis (Glenevis)	
	Bighorn (T)	(T)
	Fort McKay	(T)
	Frog Lake	
	Garden River	(T)
	Habay	
	Janvier	(T)
	Kehewin	(T)
	Meander River	(T)
	Paul Band	
	Peerless Lake	
	Stony	
	Sunchild/O'Chiese	
	Tallcree	(T)
	Trout Lake	(T)
<u>Health Office</u>	Eden Valley	

Community Health
Workers

Assumption
Bigstone
Cardston (2)
Driftpile
Edmonton (2)
Fort Chipewyan
Gleichen
Goodfish Lake
Hobbema (2)
Kehewin
Peigan
Rocky Mountain House
Saddle Lake
Sturgeon Lake
Sunchild/O'Chiese

Community Aides

Bighorn
Fort McKay
Garden River
Janvier
Peerless Lake
Chipewyan Lake

PACIFIC REGION

NORTH WESTERN ZONE - PRINCE RUPERT

M.S. FACILITIES

<u>Health Centres</u>	Bella Bella Bella Coola ? Hazelton Masset Port Simpson Prince Rupert Terrace
<u>Health Stations</u>	Aiyainsh Fort Babine Greenville Hartley Bay Kincolith Klemtu (Kitasoo) Dolphin Island (Kitkatla) Kitwancool Oweekano (Rivers Inlet) Telegraph Creek Iskut Lake (Eddontenajon) Takla Lake
<u>Community Health Workers</u>	Bella Bella Bella Coola Hazelton Kitamaat Masset Port Simpson
<u>Community Aides</u>	Fort Babine (L/D) Hartley Bay (L/D) Kitamaat Kitsegukla Klemtu Masset Oweekano Port Simpson Skidegate Takla Lake Telegraph Creek (L/D) Iskut Lake (L/D) Kitimat

PACIFIC REGION

NORTH WESTERN ZONE - PRINCE RUPERT

<u>BAND</u>	<u>POP.</u>	<u>RESERVE/LOCATION</u>	<u>MEDICAL SERVICE FACILITY</u>			
			<u>AIDE</u>	<u>TYPE</u>	<u>PARENT UNIT</u>	
Babine Lake	77	Fort Babine	Aide	H/C	Hazelton	H/C
Bella Bella	949	Bella Bella		H/C	Bella Bella	H/C
Bella Coola	505	Bella Coola		H/C	Bella Coola	H/C
Canyon City	114	Kitwilluchsilt #7			Terrace	H/C
Gitlakdamix	563	Aiyansh #1		H/S	Terrace	H/C
Glenvowell	135	Glenvowell #2			Hazelton	H/C
Greenville	441	Lachkalstap #49		H/S	Terrace	H/C
Hagwilget	123	Hagwilget (Tsitsk)			Hazelton	H/C
Hartley Bay	212	Kulkaya #4 (Hartley Bay)		H/S	Prince Rupert	H/C
Hazelton	400	Hazelton #1		H/C	Hazelton	H/C
Kincolith	365	Kincolith #4		H/S	Prince Rupert	H/C
Kispiox	434	Kispiox #1			Hazelton	H/C
Kitasoo	233	Klemtu (Kitasoo)		H/S	Bella Bella	H/C
Kitimat	654	Kitimat		(P)	Terrace	H/C
Kitkatla	414	Kitkatla (Dolphin Is.)		H/S	Prince Rupert	
Kitsegukla	305	Kitsegukla (Skeena Crossing)			Hazelton	H/C
Kitselas	40	Kitselas #1		(P)	Terrace	H/C
Kitsumkaylum	58	Kitsumkaylum #1		(P)	Terrace	H/C
Kitwancool	229	Kitwancool #1		H/S	Hazelton	H/C
Kitwanga	261	Kitwanga #1			Hazelton	H/C
	77					
Masset	1028	Masset #1		H/C	Masset	H/C
Metlakatla	70	Tsimshian #2			Prince Rupert	H/C
Moricetown	365	Moricetown #1 & Coryatsaqua			Hazelton	H/C
Nasscamp	300	Non-Indian			Terrace	H/C
Oweekano	79	Katit (Rivers Inlet)		H/S	Bella Bella	H/C
Port Simpson	821	Port Simpson #1		H/C	Port Simpson	H/C
Skidegate	358	Skidegate			Masset	H/C
Tahltan	245	Telegraph Creek		H/S	Terrace	H/C
Tahltan	186	Eddontenajon (Iskut Lake)		H/S	Terrace	H/C
Takla Lake	261	Takla Lake		H/S	Hazelton	H/C
Ulkatcho	100	Squinas #2 (Anahim Lake)			Bella Coola	H/C

PACIFIC REGION

NORTH EAST ZONE - PRINCE GEORGE

M.S. FACILITIES

<u>Health Centres</u>	Alexis Creek Prince George Williams Lake
<u>Health Stations</u>	Alkali Lake Anahim Lake Anaham Blueberry River Canoe Creek Dog Creek Doig River Fort Ware Halfway River Ingenika Sett. Lake Babine Nazko Nemiah Valley Prophet River Stone Stuart Portage (1972) Tachie
<u>Community Health Workers</u>	Alexis Creek Anaham Fort Nelson Necoslie
<u>Community Aides</u>	Alexis Creek (3) Alkali Lake Canoe Creek Prophet River Blueberry River Doig River Halfway River McLeod Lake Nazko Stone Stony Creek Tachi Williams Lake (2)

PACIFIC REGIONVANCOUVER ISLAND ZONE - FACILITY LISTING

<u>Health Centres</u>	Alert Bay Duncan Tofino
<u>Clinics</u>	Nanaimo
<u>Health Stations</u>	Kyuquot Kingcome Inlet Ucluelet 1971/72 Kuper Island 1971/72 Ohiaht 1971/72 Ahousaht Churchouse
<u>Community Health Workers</u>	Ahousaht Alert Bay Duncan
<u>Community Aides</u>	Churchouse (Homalco) Fort Rupert (L/D) (Kwawklewth) Gilford Is. (L/D) Hot Springs Cove (Hesquiat) Kingcome Inlet (Tsawataineuk) Kuper Island (Penelakut) Kyuquot Port Alberni (2) Sheshaht-Opetchesaht

NORTHERN REGION

MEDICAL SERVICES FACILITIES

Baffin ZoneHospitals

Frobisher Bay

Clinics

Frobisher Bay

Nursing Stations

Arctic Bay
 Broughton Island
 Clyde River
 Hall Beach
 Igloolik
 Lake Harbour
 Pagnirtung
 Pond Inlet
 Port Burnell
 Resolute Bay
 Cape Dorset

Health Centres

Frobisher Bay

Health Stations

Grise Fiord

Community Health Workers

Arctic Bay
 Groughton Island
 Clyde River
 Hall Beach
 Igloolik
 Pond Inlet

Visitors Accom.

Arctic Bay	(Bedroom in N/S)
Broughton Is.	(Transient Centre 8 beds)
Frobisher Bay	(Hotel)
Grise Fiord	(Bedroom in N/S)
Hall Beach	(Bedroom in N/S & Tran.Cent.)
Igloonik	(Transient Trailer Sleep 7)
Pond Inlet	(" " " 7)
Port Burwell	(Beds Available in N/S)
Resolute Bay	(Transient Trailer Sleep 7)

Inuvik ZoneHospitals

Inuvik

Clinics

Inuvik

Nursing Stations

Aklavik
 Fort Franklin
 Fort Good Hope
 Fort McPherson
 Fort Norman
 Norman Wells (1972/73)
 Tuktoyaktuk

Health Centres

Inuvik

Health Stations

Arctic Red River
 Colville Lake
 Paulatuk
 Sachs Harbour

Community Health Workers

Aklavik
 Fort Franklin
 Fort Good Hope
 Fort McPherson

Community Aides

Arctic Red River
 Colville Lake
 Paulatuk
 Sachs Harbour

Visitors Accom.

Aklavik	(1 Rm. in N/S)
Arctic Red River	(2 Beds in N/S)
Colville Lake	(2 " " ")
Ft. Franklin	(1 Bed in N/S)
Ft. Good Hope	(Trailer 4 beds & 1 bed in N/S)
Ft. McPherson	(Trailer 4 Beds)
Inuvik	(Hotels)
Ft. Norman	(Trailer 4 Beds)
Norman Wells	(Hotel 18 Rooms)
Sachs Harbour	(2 Beds in N/S)
Tuktoyaktuk	(1 Rm. in N/S)

Keewatin ZoneNursing Stations

Baker Lake
 Belcher Islands
 Coral Harbour
 Chesterfield Inlet
 Eskimo Point
 Rankin Inlet
 Repulse Bay
 Whale Cove

Health Centres

Churchill

Dental Clinic

Churchill

Community Health
WorkersBaker Lake
Eskimo Point
Rankin InletVisitor Accom.Chesterfield Inlet (At mission)
Coral Harbour (Trailer)MacKenzie ZoneHospitalsClinicsCambridge Bay
Fort Rae
Fort SimpsonNursing StationsCambridge Bay
Coppermine
Edzo (1973/74)
Ft. Liard
Ft. Providence
Ft. Resolution
Ft. Wrigley (1972/73)
Gjoa Haven
Holman Island (1972/73)
Snowdrift (1972/73)
Spence BayHealth CentresHay River
Ft. Simpson
Ft. Smith
YellowknifeHealth StationsPelly Bay
Lac La Martre (Summer Only)
Nahanni Butte (1971/72)Community Health
WorkersFt. Resolution
Ft. Simpson
Ft. Rae
Spence Bay

Community Aides

Hay River
 Lac La Martre
 Pelly Bay
 Rae Lake (U)
 Trout Lake (U)

Visitor Accom.

Cambridge Bay (Trailer 6 Bunks)
 Ft. Liard (1 Bed at N/S)
 Ft. Resolution (Patient Beds in N/S)
 Ft. Smith (Hotels)
 Ft. Providence (Motels)
 Ft. Wrigley (1 Bed in N/S)
 Gjoa Haven (1 Rm. in N/S & T.C. 5 Beds)
 Hay River (Hotels - Motels)
 Holman Island (Trans. Centre 10 Beds)
 Pelly Bay (Trans. Centre)
 Pine Point (Hotel)
 Snowdrift (1 Bed in N/S)
 Spence Bay (Trailer 6 beds)
 Yellowknife (Hotels - Motels)

Yukon ZoneHospitals

Whitehorse
 Mayo

Clinics

Whitehorse

Nursing Stations

Dawson
 Faro
 Old Crow
 Watson Lake

Health Centres

Carmalks (1971/72)
 Dawson
 Haines Junction
 Teslin
 Watson Lake
 Whitehorse

Health Stations

Beaver Creek
 Burwash Landing (1971/72)
 Carcross
 Pelly Crossing
 Ross River
 Upper Liard

Community Health Workers

Faro
 Ross River
 Teslin
 Upper Liard
 Whitehorse

Community Aides

Beaver Creek
 Burwash
 Carcross
 Carmacks
 Dawson
 Faro
 Haines Junction
 Pelly Crossing
 Ross River
 Teslin
 Upper Liard

Visitor Accom.

Beaver Creek	Motel
Burwash	Hotel
Carcross	Hotel
Carmacks	Hotel - Motels
Dawson	Hotels - Motels
Faro	Hotel
Haines Junction	Motel
Pelly Crossing	Motel
Ross River	Hotel - Motel
Teslin	Motels
Upper Liard	Motel
Destruction Bay	Motel
Elsa	Lodge
Mayo	Hotel - Motel
Old Crow	Nursing St.
Watson Lake	Hotel - Motel
Whitehorse	Hotels

NORTHERN HEALTH SERVICES, SAMPLE BUDGET

Description	\$'000's	
	1971/72	1972/73
<u>BY SUB-ACTIVITY</u>		
Treatment	5,375	8,816
Public Health	4,469	1,971
Involvement of Northern Residents	-	-
Northern Health Support	1,250	1,312
<u>TOTAL</u>	<u>11,094</u>	<u>12,099</u>
<u>BY RESPONSIBILITY</u>		
Branch Headquarters	37	106
Northern Region	11,057	11,993
<u>TOTAL</u>	<u>11,094</u>	<u>12,099</u>
<u>BY STANDARD OBJECTS</u>		
01 Personnel	5,576	6,102
02 Transportation and Communications	1,630	1,621
03 Information	17	23
04 Professional and Special Services	1,511	1,787
05 Rentals	248	220
06 Purchased Repair and Upkeep	111	120
07 Utilities, Materials and Supplies	2,001	2,226
12 Miscellaneous	-	-
<u>TOTAL</u>	<u>11,094</u>	<u>12,099</u>

MEDICAL FACILITIES TERMINOLOGYDescription of Facilities

The term "health facility" is a general term and may be used to describe any Branch Service ranging from a community aide (lay dispenser) to a hospital.

1. Community Aide (includes old style "lay dispenser")

A contact in a community (of usually 50 or more persons) to whom Indians and Eskimos may come when they need assistance when there is no full-time nurse or doctor. Where there is no Health Station (overnight cabin), a store of drugs, liniments, bandages, household remedies is kept by the aide in his/her home and patients are treated in the home.

2. Health Office

A building or space in a building, which is not for the exclusive use of Medical Services, where a nurse and/or doctor may, from time to time, hold clinics or conduct public health education activities.

3. Health Station

A small building or trailer usually under the charge of a community aide; where a visiting nurse or doctor may render services such as immunization, public health education, etc., and might, in an emergency, take in an overnight patient and where the nurse may stay overnight if necessary.

4. Health Centre

A building, trailer or rented office space staffed by one or more full-time nurses (and possibly some assistant staff) and is the focal point of the public health program in an assigned area, but may occasionally be used for treatment services.

Accommodation for staff is provided only where no other suitable accommodation is available.

5. Nursing Station

A field unit staffed by two or more nurses and subsidiary staff. It normally provides accommodation for the nursing staff, has two to fourteen beds for patient care, a clinic and out patient facilities and is also the centre of the public health program for the assigned area.

6. Clinic

A field unit, usually connected with a hospital, under the direction of a medical doctor on a continuing basis whether full-time, part-time or by special agreement.

7. Hospital

An institution of fifteen beds or more operated for the regular accommodation of in-patients in which medical and surgical care for illness and obstetrics is possible.

CACC / CCAC



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