Q. **Re: p. B-137** Produce the Project Descriptions and Justifications for each time that Hydro has proposed replacement of this VHF Mobile Radio System.

A. Project Descriptions and Justifications submitted in 2001 and 2003 are attached.

GENERAL PROPERTIES:

Replace VHF Mobile Radio System ($8,373,000)

Nature of Project
This project involves the replacement of the existing VHF mobile radio system. This system was installed in 1989 and is obsolete. The system comprises 30 repeaters located across the Island, a central switch located in Gander, and mobile and portable user radios. The equipment is obsolete and has not been supported by the manufacturer for 10 years. The existing inventory of spares is not sufficient to extend the life of the system.

Customer Impact
This replacement is required to ensure that Corporation personnel have access to mobile communications during routine and emergency maintenance and repair.

Cost Benefit Study
A formal cost benefit study was not required.

Future Commitments
There are no future commitments, this project will be completed in 2002.

GENERAL PROPERTIES:

* **Replace VHF Mobile Radio System ($3,081,000; Future $5,640,000)**

Nature of Project
This project involves the replacement of the existing VHF mobile radio system. The existing system consists of a single non-redundant switch located in Aliant's Gander Central Office, site controllers and radio repeaters located at each of 29 sites across the island, and approximately 350 mobile and portable radios.

The original system designer, ATI, ceased operations in 1991 after manufacturing four (4) other systems. The switch and site controllers manufactured by ATI are obsolete and have not been supported by ATI since 1991. Also, the existing system is not Y2K compliant, can not be expanded to meet Hydro's existing coverage requirements and does not allow configuration changes for additional functionality.

Customer Impact
This replacement is required to ensure that Corporation personnel have access to mobile communications during routine and emergency maintenance and repair.

Cost Benefit Study
A formal cost benefit study was not required.

Future Commitments
* This is a two-year project starting in 2002 and ending in 2003.

* **Note:** The previous submission of $8.3 million was based on a partnership arrangement with Aliant. It was originally intended that Aliant would do the detailed engineering specification for the project in 2001 with release of the project in 2002, however, a suitable partnership agreement could not be reached with Aliant to the satisfaction of all parties. The increased costs and the decision to forecast this project over a two year period reflects that Hydro will prepare the specification documents and that a tender award is not probable until the end of 2nd quarter of 2002, making delivery of this project in 2002 an impossibility.

GENERAL PROPERTIES:

* **Replace VHF Mobile Radio System ($3,081,000; Future $5,640,000)**

Nature of Project
This project involves the replacement of the existing VHF mobile radio system. The existing system consists of a single non-redundant switch located in Aliant's Gander Central Office, site controllers and radio repeaters located at each of 29 sites across the island, and approximately 350 mobile and portable radios.

The original system designer, ATI, ceased operations in 1991 after manufacturing four (4) other systems. The switch and site controllers manufactured by ATI are obsolete and have not been supported by ATI since 1991. Also, the existing system is not Y2K compliant, can not be expanded to meet Hydro's existing coverage requirements and does not allow configuration changes for additional functionality.

Customer Impact
This replacement is required to ensure that Corporation personnel have access to mobile communications during routine and emergency maintenance and repair.

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A formal cost benefit study was not required.

Future Commitments
* *This is a two-year project starting in 2002 and ending in 2003.*

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* **Note:** After further discussion with the equipment manufacturer, it was determined that it was not possible to complete the project in one year, therefore a decision was made to do the project over 2 years. The extended period of performing the project is the reason for the increase in the project estimate.

2004 CAPITAL PROJECTS OVER $50,000
EXPLANATIONS

Project Title: Replace VHF Mobile Radio System

Location: Various

Division: Production

Classification: Information Systems & Telecommunications

Project Description:

This project involves the replacement of the Corporation's existing VHF mobile radio system with a trunked radio system. The replacement of the existing system involves replacing the equipment at 29 repeater sites, as well as the replacement of a central switch located in Gander, approximately 250 mobile and base station radios, and approximately 100 portable radios. The proposed system will provide additional coverage to meet the Corporation's requirements.

Project Cost: *($ x1,000)*	**2004**	**2005**	**Beyond**	**Total**
Material Supply	25.0	105.0	0.0	130.0
Labour	2,520.0	3,840.0	0.0	6,360.0
Engineering	175.0	200.0	0.0	375.0
Project Management	0.0	0.0	0.0	0.0
Inspection & Commissioning	0.0	0.0	0.0	0.0
Corp O/H, AFUDC, Esc. & Contingency	328.0	1,657.0	0.0	1,985.0
Total	**3,048.0**	**5,802.0**	**0.0**	**8,850.0**

Operating Experience:

The existing system was purchased in 1989 and is obsolete. The failure statistics for the VHF have increased considerably over the past year. There are no longer trained resources at Aliant knowledgeable about the VHF switch which also puts the system at risk.

VHF Failure Statistics

Year	Facility	Repeater	Switch	Other
1998	14	6	0	9
1999	3	4	1	5
2000	6	4	0	5
2001	4	4	1	1
2002	5	7	5	0
2003*	9	4	19	3
* Represents 2 months (January & February)				

2004 CAPITAL PROJECTS OVER $50,000
EXPLANATIONS

Project Title: Replace VHF Mobile Radio System **(cont'd.)**

Project Justification:

The proposed replacement system is a standards-based trunked mobile radio system. By purchasing a standards-based system, the Corporation's investment is protected in the long-term, as the system is not tied to a single manufacturer. A trunked system permits the deployment of additional users or applications seamlessly and without the need for large scale changes to the system.

The business case analysis is attached to Section G, Appendix 4.

Future Plans:

None.

BUSINESS CASE

FOR

VHF Mobile Radio System Replacement

March 25, 2003

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1.0 EXECUTIVE SUMMARY

Newfoundland & Labrador Hydro presently owns a VHF mobile radio system which serves both its employees and the provincial Department of Works, Services, and Transportation (WS&T) with mobile radio services for their respective personnel and vehicles. This system has been in service since 1989 and has now reached the end of its useful life, owing primarily to the unavailability of parts and service for the equipment.

It is concluded that the most viable option for Hydro is to replace the current system with a trunked radio system. Unlike the existing conventional system, trunked radio allows users to share radio channels, thereby providing economies of scale when multiple radio channels are required for traffic requirements. Trunked radio is also much more user friendly than conventional radio, with a user interface similar to a telephone.

Alternatives evaluated to provide mobile communications include cellular telephone, satellite telephone, and mobile radio and the analysis concluded that a trunked mobile radio solution is the preferred alternative. The mobile radio alternative has been demonstrated to be the only feasible alternative for a variety of reasons.

The estimated capital cost of this system, including indirect costs, is $8.85 million, with $5.8 million in direct costs. Annual operating costs of $690,000 (2005 dollars) are also anticipated. WS&T will share in the costs of the system on a prorated number of users basis.

Based on the analysis undertaken in this report, it is recommended that the Corporation purchase and install a trunked VHF mobile radio system that provides coverage on the Island of Newfoundland and selected areas of Labrador. While the trunked radio solution has a Net Present Value of $130,000 or approximately 2% more than the conventional radio, it provides greater technical flexibility for adding future users and the utilization of other features.

2.0 PROJECT DEFINITION

2.1 Purpose

The purpose of this project is to replace Newfoundland & Labrador Hydro's (the Corporation's) existing VHF Mobile Radio System (MRS). The existing system was installed in 1989 and has reached the end of its useful life. It is proposed to be replaced by a trunked radio system capable of providing service to the corporation's employees and its' current, as well as future, customers.

The MRS would provide mobile radio service on the Island of Newfoundland, the southern coast of Labrador and Happy Valley - Goose Bay. Coverage (the area of service) will include major roads, communities, and the Corporation's transmission lines and generating stations.

2.2 Justification

Mobile communication is a fundamental requirement for the efficient deployment of a utility's workforce whose work site covers virtually all the province where its transmission, distribution and generation facilities are located. In fact all major utilities have mobile radio systems as an essential component of their operation. Mobile communication is used for employee dispatch, status communications, communication between crews working separately on a geographically distributed asset, such as a transmission line, and for emergency communications. The Corporation has used a mobile radio system since at least the 1970's; the existing system is the second generation of MRS owned and operated by the Corporation. The Corporation's users regard the system as an absolute necessity in the performance of daily operations and the requirement for communications is an integral part of the corporation's work protection code.

Ownership of the MRS by the Corporation is consistent with standard industry practice. The majority of major utilities in Canada own their MRS facilities (see Appendix B), as opposed to leasing service from a service provider. This is done for a variety of reasons, but primarily because without ownership, the utility is subject to the business priorities of a service provider who may change the coverage, technology, service level, and cost of a leased system at any time. As an example, Aliant has reduced the coverage and service for its mobile telephone system as cellular telephony has eliminated most of the customer base, and it has now sought permission from its regulator to discontinue this service completely. Ownership of the utility's MRS brings control of a critical piece of infrastructure required to operate and maintain the electrical grid of a major utility.

With the requirement for mobile communications established, the next issue is the necessity of replacement of the existing system. The existing MRS is one of a handful that were installed in Canada by the original manufacturer; and is one of two systems still in service today. It consists of a central switch located in Gander, and 29 repeaters scattered across the Island of Newfoundland; each repeater consists of one site controller, one mobile transmitter/receiver, and one transmitter for paging. The switch/site controller system was Manufacturer Discontinued (MD'd) in 1991, and service and spare parts are no longer available. The switch is non-redundant, meaning that failure of a key component can render the entire system inoperable. The transmitters and receivers were MD'd in 1996, but can be replaced with compatible equipment. Typically manufacturers will discontinue support completely after equipment has been MD'd for 10 years. The graph shown in Appendix A.8 indicates the failure statistics for the period 1999 to February 2003 and clearly demonstrates the increasing failure rate.

When the original budget for this project was prepared in early 1997 the scope of the project was to replace only the central switch in 2000. The estimate at that time was approximately $1.2 million. The scope of this project was revisited in 1998, after the Corporation became aware of the manufacturer's intent to MD the repeater equipment, and a decision was made at that time that the most viable alternative was to replace the system completely, as much of the equipment was reaching the end of its useful life and

would have to be replaced in the near future in any case. At that time a capital estimate of approximately $8.2 million was submitted. Further refinement of the estimate for resubmission caused the estimate to change to its current value of $8.85 million.

In late 1999, a consultant was tasked with analysis of the Corporation's mobile communications requirements and determination of the most cost effective solution. The consultant that was hired has extensive experience in the design and analysis of MRS.

The consultant's report is contained in Appendix C attached. In summary, it demonstrates that a standards-based trunked radio system is the most cost effective solution to the mobile communication needs of the Corporation. It also contains cost estimates that were used in the preparation of the capital job cost, as well as the cost-benefit analysis contained in Section 6 of this document.

2.3 Objectives

The objectives of this project are as follows:

- To provide the most cost-effective, reliable mobile communications system for the Corporation's workforce and customer;
- To maximize the life and minimize installation and operating costs by using standards-based technology wherever possible;
- To maintain and where feasible increase coverage of the system;
- To utilize Hydro-owned facilities wherever possible to minimize installation and operating costs.

2.4 Scope/Major Deliverables

This is a one-phase project to be implemented over two years. The major deliverables include the following:

- Trunked MRS infrastructure, including but not limited to standards-based switching equipment, site controller equipment, and system management hardware/software;
- Mobile repeater equipment, including transceivers, antennas, filtering equipment, and all associated hardware;
- Approximately 350 mobile and portable radios are apportioned in the approximate ratio of 70% mobile and 30% portable;
- Increased coverage where required, as long as it is demonstrated to be economically and technically feasible;
- User and maintenance training;
- Spare parts.

2.5 Assumptions

Assumptions used in the development of this business case, the project capital job cost, and related documentation include the following:

- Repeaters will be installed at microwave radio sites owned by the Corporation whenever it is technically sound;
- The system will be designed to maximize the use of interconnect facilities owned by the Corporation, as opposed to leasing these facilities;
- Ongoing maintenance of the system will be performed by a third party at sites not owned by the Corporation, and by internal personnel at sites owned by the Corporation.

2.6 Constraints and Prerequisites

Constraints on this project include the following:

- Service must be maintained on the existing system during the installation and commissioning of the new system, in order to minimize outage time for users;
- The East-West Microwave Interconnect project must be completed in advance of installing facilities in the Central, Western, and Northern Newfoundland areas in order to provide the required facilities;
- Available VHF channels may be restricted in certain areas by Industry Canada licensing restrictions.

3.0 STRATEGIC ALIGNMENT

3.1 Specific Strategic Initiatives

The corporation's Mission Statement is as follows:

Newfoundland & Labrador Hydro is a Crown Corporation committed to providing cost-effective and reliable energy services to our customers for the benefit of all people of the province.

Our skilled and committed employees will use innovative methods and technologies, and will maintain high standards of safety and health, and environmental responsibility.

The project maintains this mission by allowing employees to perform their work more efficiently, while helping maintain a safe working environment when operating remotely.

3.2 Project Stakeholders

The project stakeholders include all IS&T sections from a management, installation, and maintenance standpoint, and all divisions of the Corporation, as well as WS&T.

Within IS&T, Infrastructure & Software Support is responsible for the maintenance and ongoing support for the system. Technology Planning is responsible for standards compliance and integration into the overall IS&T Strategic Plan. Project Delivery is responsible for project management of the installation.

4.0 APPROACHES

4.1 Identification of Alternatives

In a preliminary analysis of this project, the following alternatives were identified:

- Cellular telephone;
- Satellite telephone;
- Replace of existing switch and maintain radio equipment;
- Install new radio system.

4.2 Comparison of Alternatives

Cellular Telephone

The possibility of using cellular telephones was explored to see if it could meet the corporation's requirements. Cellular telephone could provide some of the capability of a mobile radio system, but not all. The major problems with cellular are:

Poor Coverage

Cellular coverage does not extend to many of the more remote areas where the Corporation requires mobile communications, including central Newfoundland and large portions of the West Coast and Northern Peninsula, as well as southern Labrador.

Insufficient Facilities

As a shared communications system, cellular telephone, like traditional telephone networks, does not have sufficient resources to permit all its users to communicate simultaneously. Instead, channels are allocated based on an acceptable level of service and statistical analysis of usage patterns. In practical terms, in a major emergency, or any time when a large number of users try to access the system simultaneously, many users will not receive service. This unavailability of service is totally unacceptable from a service restoration and safety perspective and is sufficient to eliminate cellular as a meaningful alternative. Emergency situations like major storms are the times when the Corporation's personnel, as well as WS&T, need guaranteed communications.

Lack of Functionality

Some features of mobile radio systems greatly assist operations such as line maintenance, where several personnel at different locations have a need to communicate simultaneously. These are functions which cellular telephone does poorly, if at all.

Industry Practices

In the utility industry, mobile radio systems are recognized as the standard communications medium to support operations. Cellular telephone has been used in some instances but only to enhance the coverage of the mobile radio system in a particular area or for routine business communications.

Conclusion

For the reasons given above, it was determined that the cellular telephone was not a viable replacement for a corporate mobile radio system.

Satellite Telephone

Satellite telephone systems address the issue of coverage that limits the usefulness of cellular telephony, but the other disadvantages, namely insufficient facilities and lack of functionality, remain.

When discussing satellite telephony it is important to distinguish between two types of service. Geostationary (GEO) satellite service requires a directional antenna with a clear view to the southwest and is unsuitable for backcountry mobile service and therefore not a viable alternative. Low Earth Orbit (LEO) services are second generation and are not directional. LEO services are discussed herein.

Stability of Service Providers

Most LEO satellite service providers are operating on the edge of insolvency. The customer numbers that were envisioned when the original business plans for these systems never materialized, as cellular telephony coverage increased. As well, the high cost of satellite service has deterred many potential customers. Iridium, the original low earth orbit satellite telephony service, declared bankruptcy shortly after providing its original service and only continues to provide service through a last minute contract from the United States government. Globalstar, the second satellite service to be placed in service, sought bankruptcy protection in February of 2002. To attempt to use either of these services as a mobile communications system would be an extremely high-risk proposition. If the service is abandoned the time to install an alternate would expose the customer to unacceptable business and safety risk.

Availability of Advanced Services

LEO satellite telephones are acceptable for point-to-point communications; however, a large proportion of the calls made on a typical MRS are multipoint calls, involving several users. Also, network management requires visibility of the service to determine if the service is working or not. These are a few examples of services that are required for a critical communications system that are not available using satellite telephony.

Utility Practices

In the utility industry, mobile radio systems are recognized as the standard communications medium. Similar to cellular telephones, satellite telephones are used in some instances but only to enhance the coverage of the mobile radio system in a particular remote area. Because of the per unit cost of a satellite phone and the airtime cost, the satellite phone is typically the last option to be pursued.

Conclusion

Because of the reasons given above, it was determined that the satellite telephone was not a viable replacement for a corporate mobile radio system.

Replacement of Switch in 2004 Alternative

One possible solution to the problem of switch obsolescence would be to replace the switch and site controllers only, and leave the rest of the system intact. This scenario was originally proposed in the Corporation's Telecommunications Plan of 1997. This could be achieved without significantly changing the functionality of the system. Under this scenario, mobile and repeater radios would not change until they were replaced as they began to fail. When the switch replacement option was proposed, the corporation was unaware that the repeaters had been manufacturer discontinued (MD'd) in 1996.

This scenario has several significant disadvantages.

Age of Equipment

The remaining mobile and portable radios as well as the repeater equipment are at the end of their useful lives, and as a result, maintenance costs and failures are increasing. The equipment was MD'd in 1996 and typically manufacturers will provide best effort support for 10 years and after that no support is provided. Based on this, in 2006 support for the repeater equipment will no longer be available. To delay the replacement of the repeaters for a few years will only result in increased maintenance costs and delay the inevitable replacement of the system.

Lack of Functionality

By replacing the switch now and leaving the rest of the system intact, the Corporation would be unable to take advantage of any of the modern features that a replacement system would have to offer. Essentially, the corporation would be restricted to the same technology until the complete system is replaced. Additional features of a new system would include privacy, individual calling, remote unit registration, ease of expansion, as well as the ability to provide data capability to mobile personnel and isolated sites accessible only by VHF radio.

Additional repeaters are required to meet the corporation's existing coverage requirements. These new repeaters may not be able to be re-used when the MRS is ultimately replaced.

Inability to Use Existing Corporate Infrastructure

Because of the West Coast Microwave upgrade completed in 1999, the East Coast Microwave project completed in 2001, and the East-West Interconnect being completed in 2003, the Corporation is now in a position to use its infrastructure to support part of the VHF mobile radio system. Doing this, however, will mean the removal of approximately ten repeaters from Newtel sites, and their installation in Hydro sites.

Complete Radio System Replacement

Over the past several years, the Corporation has worked with Newtel Mobility to solicit support from major provincial users of mobile radio systems for a province wide VHF mobile radio system. This initiative has not been successful, and therefore the Corporation has little choice but to proceed with a replacement of the existing system.

Replacing the existing system with a new solution allows the Corporation to provide its employees and customers an advanced, private system that meets both current and planned needs for mobile communications.

Coverage

Internal users have indicated a desire to see the coverage, i.e. the geographical area of service availability, of the existing system increased. In particular, the South Coast of Labrador and Happy Valley-Goose Bay and the Granite Canal area have been identified as areas where additional coverage will be needed. In order to achieve this, six additional repeaters have been included in the budget. The actual number of sites will be determined upon performance of a detailed coverage analysis. If WS&T requires any additional coverage outside of the Corporation's requirements, it will be at the expense of WS&T and outside the scope of this project.

In addition to extra repeaters, the second variable that determines the coverage for a given power level and tower height is the frequency of the transmitted signal. Analysis

has demonstrated that the VHF (170 MHz) mobile band currently used by the Corporation's mobile radio system will provide the best coverage using the minimum number of repeater sites.

Trunked radio refers to a mobile radio technology whereby a single repeater location may have more than one radio channel for user traffic. The channels are shared between users in a manner that permits more simultaneous conversations than the total number of channels, a feat that is achieved by reallocating a channel to a new conversation as soon as the user is finished, instead of having the traditional "hold time" of a conventional radio channel.

Technology Alternatives

Several types of trunked radio systems are available, each with its own unique properties. A consultant was hired in early 2001 to assist with the evaluation of the alternatives. Broadly speaking, the trunked radio systems can be classed as either proprietary or standards-based. Standards based systems are, in general, less expensive owing to the availability of multiple vendors.

5.0 COST/BENEFIT ANALYSIS

5.1 Switch Only Replacement

The analysis for a switch only replacement was completed. Attached in Appendix A are two switch replacement options. Option 1 is a Switch Replacement in 2004 followed by a complete replacement of the MRS by 2008. Option 2 is a Switch Replacement in 2004 followed by a complete replacement of the MRS by 2011. Both of these options are compared to a MRS replacement in 2005.

Option 1 allows the repeater equipment to go 2 years beyond the end of any manufacturer support and option 2 allows the repeater equipment to go 5 years beyond the end of manufacturer support.

The evaluation period was from 2004 to 2019 and is summarized in the following table:

Option	NPV
Mobile Trunked Radio System (MRS)	$10,827,896
Switch Replacement in 2004 with MRS in 2008	$12,008,866
Switch Replacement in 2004 with MRS in 2011	$12,229,819

These results are indicated in tabular and graph form in Appendix A as A.1, A.2 and A.3.

As is evident from the analysis, the most viable long-term alternative is to install a mobile trunked radio system in 2004/2005 rather than pursue a piece meal approach.

5.2 Conventional vs. Trunked Mobile Radio Systems

The preliminary NPV analysis contained in Appendix A evaluates the cost over 15 years of a conventional radio system, such as the existing system, and a trunked radio system. Two alternatives are presented: one is a Hydro only system and the second with WS&T contributing 50% of the costs. As shown, over the assumed 15-year life, the trunked radio system cost is marginally higher than the conventional system, owing to higher leasing costs for the assumed configuration. If however the required number of leased circuits were to increase, the increased cost for trunked radio is proportionally lower, meaning that this estimate is probably conservative.

The following table summarizes the results for the scenario under which Hydro is the sole user:

Option	Capital	Operating	Total
Trunked	$5,700,000	$5,127,896	$10,827,896
Conventional	$6,625,000	$3,972,828	$10,597,828
Difference			$230,068

The tabular and graphical representation are illustrated in Appendix A.4 and A.5 respectively. As shown, the difference in total cost is negligible (approximately 2%) compared to the total cost of ownership of the system over 15 years.

If it is assumed that WS&T bears 50% of the total cost, the difference is halved:

Option	Capital	Operating	Total
Trunked	$2,850,000	$2,563,948	$5,413,948
Conventional	$3,312,500	$1,986,414	$5,298,914
Difference			$115,034

The tabular and graphical representation are illustrated in Appendix A.6 and A.7 respectively. Again, the difference for trunked radio compared to conventional is on the order of 2% of the total cost of ownership.

5.3 Proposed Technical Alternative

It is recommended that a mobile trunked radio system be installed in 2004/2005. While the NPV indicates a marginally preference for a conventional mobile radio system, the mobile trunked radio system allows for greater flexibility for the users and will provide a more economic alternative if additional users are added to the system.

Benefits of the proposed solution have already been enumerated; however, in summary form, the major benefits are as follows:

- The system will provide the Corporation's mobile communications needs for the foreseeable future;
- The modular nature and standards-based design of the proposed solution ensures that future expansion needs will be met;
- The same system can be used to provide communications for CF(L)Co in future, thereby ensuring that the most efficient solution for both organizations is maintained;
- The trunked solution will be able to be expanded to include mobile data capability, thereby improving the efficiency of the mobile workforce.

6.0 RESOURCE REQUIREMENTS

6.1 Human Resource Requirements

The attached is an order of magnitude estimate of the effort involved in the design, installation, and commissioning of this project.

1.1.1 Role	Responsibility	1.1.1.1 Time Commitment	1.1.1.2 Duration	Source (internal, external)
Project Manager	Overall coordination of project	1 person year	2 years	Internal
Technical Lead	Project engineering	1.5 person years	2 years	Internal
Technologist	Installation/commissioning	3 person years	2 years	Internal
Project Manager	Coordination of supplier effort	1 person year	2 years	External
Design Engineer	Detailed design of proposed solution	1 person year	2 years	External
Installer	Installation/commissioning	3 person years	2 years	External

6.2 Material/Equipment Procurement

The proposed solution will be obtained through a detailed design/supply/install/commission contract. This is the approach normally taken by IS&T in a system of this magnitude. This allows the Corporation to take advantage of the skills normally contained in-house by a reputable supplier, and at the same time focus its resources on the areas in which it has expertise.

7.0 BUSINESS IMPACT

7.1 Changes to the Business Process

Changes to business processes will be minimal. Staff complements in St. John's, Bishop's Falls, and Deer Lake already possess the necessary skills to operate and maintain the system, needing only training on the specific equipment being provided. Engineering support and software/hardware support will be provided with existing complement, primarily from St. John's.

Because the replacement system is similar to the existing MRS in size and complexity, process changes will be minimal. Preventive Maintenance, which is currently performed on the existing system, will be adapted to the new system, and Network Management will be performed using the resources of the Network Management Centre located in St. John's.

7.2 New Staff Training Needs

As with any new installation, some training will be required. All users will have to be trained on the use of the system. Network Services personnel will be trained on the maintenance and service of the equipment. The cost of this training is included in the capital cost estimate.

7.3 Changes with Stakeholders

In preliminary discussions, WS&T has indicated a desire to participate in the venture by contributing to the cost, to be prorated based on the number of radios each party uses. In the current installation, the radios are divided roughly evenly between the Corporation and WS&T; it is therefore reasonable to assume that WS&T will contribute approximately half the capital and operating cost of the system.

Discussions with Newfoundland Power personnel indicate that they are not interested in proceeding as a partner in the development of this system because they still have a viable system; however, they may wish to participate at some later date.

Discussions with other parties, e.g. provincial government agencies, on the possibility of participation in this system are ongoing.

8.0 CONCLUSION

The analysis presented addressed the possibility of using cellular as well as satellite telephony and both were eliminated as viable alternative as they do not fulfill the demands of the utility environment.

Consideration was given to a switch replacement as was proposed in 1997; however, it is not economic in the long-term. Two technologies of mobile radio were compared namely conventional and trunk. The conventional mobile radio system is marginally less expensive than a trunked system, however, the benefits of the trunked radio make it the preferred option for our industry.

These benefits include ease of use of additional users, data capability (with some additional capital) amongst others. It will provide Hydro over the long-term a reliable and flexible system that serves the needs of the work force across the province for safety and efficiency reasons.

It is concluded that Hydro should proceed with the installation of a mobile trunked radio system as soon as possible, as any further delay will likely result in the unavailability of any system due to the deteriorating performance of the current system.

APPENDIX A

VHF Mobile Radio Replacement

Switch Replacement in 2004 (Option 1)

Study Discount Rate: 9.60%

	Switch Replacement				Trunked Radio System				NPV Comparison (Alt. 2 - Alt. 1)
Year	Capital Costs	O&M Costs	Total	CPW to 2004	Capital Costs	O&M Costs	Total	CPW to 2004	CPW to 2004
2004	1,444,842	551,250	1,996,092	1,996,092	3,000,000		3,000,000	3,000,000	$ 1,003,908
2005		633,938	633,938	2,574,502	2,700,000	689,250	3,389,250	6,092,381	$ 3,517,880
2006		729,028	729,028	3,181,410		689,250	689,250	6,666,175	$ 3,484,765
2007	3,200,508	838,382	4,038,891	6,249,234		689,250	689,250	7,189,709	$ 940,475
2008	2,880,457	964,140	3,844,597	8,913,690		689,250	689,250	7,667,386	$ (1,246,304)
2009	(103,322)	689,250	585,928	9,284,193		689,250	689,250	8,103,223	$ (1,180,970)
2010		689,250	689,250	9,681,855		689,250	689,250	8,500,885	$ (1,180,970)
2011		689,250	689,250	10,044,684		689,250	689,250	8,863,715	$ (1,180,970)
2012		689,250	689,250	10,375,733		689,250	689,250	9,194,764	$ (1,180,970)
2013		689,250	689,250	10,677,785		689,250	689,250	9,496,816	$ (1,180,970)
2014		689,250	689,250	10,953,380		689,250	689,250	9,772,411	$ (1,180,970)
2015		689,250	689,250	11,204,836		689,250	689,250	10,023,866	$ (1,180,970)
2016		689,250	689,250	11,434,266		689,250	689,250	10,253,296	$ (1,180,970)
2017		689,250	689,250	11,643,599		689,250	689,250	10,462,630	$ (1,180,970)
2018		689,250	689,250	11,834,598		689,250	689,250	10,653,628	$ (1,180,970)
2019		689,250	689,250	12,008,866		689,250	689,250	10,827,896	$ (1,180,970)

Notes:

1. Summary of Capital Costs for Switch Replacement:

2004	The cost of switch replacement was calculated based on the 1997 estimate of $1,269,200. Using an average inflation rate of 2.16% per year, the cost of switch replacement was estimated at $1,444,842 in 2004.
2007-2008	The useful life of the existing system would be extended by 5 years with the replacement of the central switch. A new system would still need to be installed and operational in 2008. The cost of completely replacing the existing system was estimated using the Trunked Radio System estimate, assuming an average inflation rate of 2.18%.
2009	It is estimated that the central switch would have a salvageable value of $103,322 (using a declining balance depreciation calculation at 30% per year).

2. Summary of O&M Costs for Switch Replacement

2004-2008	Due to the increasing age of the current system, the O&M costs were assumed to be the same as the Conventional Radio System in the first year and then increasing 15% per year for each subsequent year that the system is in service.

APPENDIX A.2

VHF Mobile Radio Replacement
Swith Replacement in 2004 (Option 2)

Study Discount Rate: 9.60%

	Switch Replacement				Trunked Radio System				NPV Comparison (Alt. 2 - Alt. 1)	
Year	Capital Costs	O&M Costs	Total	CPW to 2004	Capital Costs	O&M Costs	Total	CPW to 2004		CPW to 2004
2004	1,444,842	551,250	1,996,092	1,996,092	3,000,000		3,000,000	3,000,000	$	1,003,908
2005		633,938	633,938	2,574,502	2,700,000	689,250	3,389,250	6,092,381	$	3,517,880
2006		729,028	729,028	3,181,410		689,250	689,250	6,666,175	$	3,484,765
2007		838,382	838,382	3,818,221		689,250	689,250	7,189,709	$	3,371,488
2008		964,140	964,140	4,486,408		689,250	689,250	7,667,386	$	3,180,979
2009		1,108,761	1,108,761	5,187,516		689,250	689,250	8,103,223	$	2,915,708
2010	3,414,418	1,275,075	4,689,492	7,893,109		689,250	689,250	8,500,885	$	607,776
2011	3,072,976	1,466,336	4,539,312	10,282,659		689,250	689,250	8,863,715	$	(1,418,945)
2012	(35,439)	689,250	653,811	10,596,687		689,250	689,250	9,194,764	$	(1,401,923)
2013		689,250	689,250	10,898,739		689,250	689,250	9,496,816	$	(1,401,923)
2014		689,250	689,250	11,174,333		689,250	689,250	9,772,411	$	(1,401,923)
2015		689,250	689,250	11,425,789		689,250	689,250	10,023,866	$	(1,401,923)
2016		689,250	689,250	11,655,219		689,250	689,250	10,253,296	$	(1,401,923)
2017		689,250	689,250	11,864,553		689,250	689,250	10,462,630	$	(1,401,923)
2018		689,250	689,250	12,055,551		689,250	689,250	10,653,628	$	(1,401,923)
2019		689,250	689,250	12,229,819		689,250	689,250	10,827,896	$	(1,401,923)

Notes:

1. Summary of Capital Costs for Switch Replacement:

2004 The cost of switch replacement was calculated based on the 1997 estimate of $1,269,200. Using an average inflation rate of 2.16% per year, the cost of switch replacement was estimated at $1,444,842 in 2004.

2010-2011 The useful life of the existing system would be extended by 8 years with the replacement of the central switch. A new system would still need to be installed and operational in 2011. The cost of completely replacing the existing system was estimated using the Trunked Radio System estimate, assuming an average inflation rate of 2.18%.

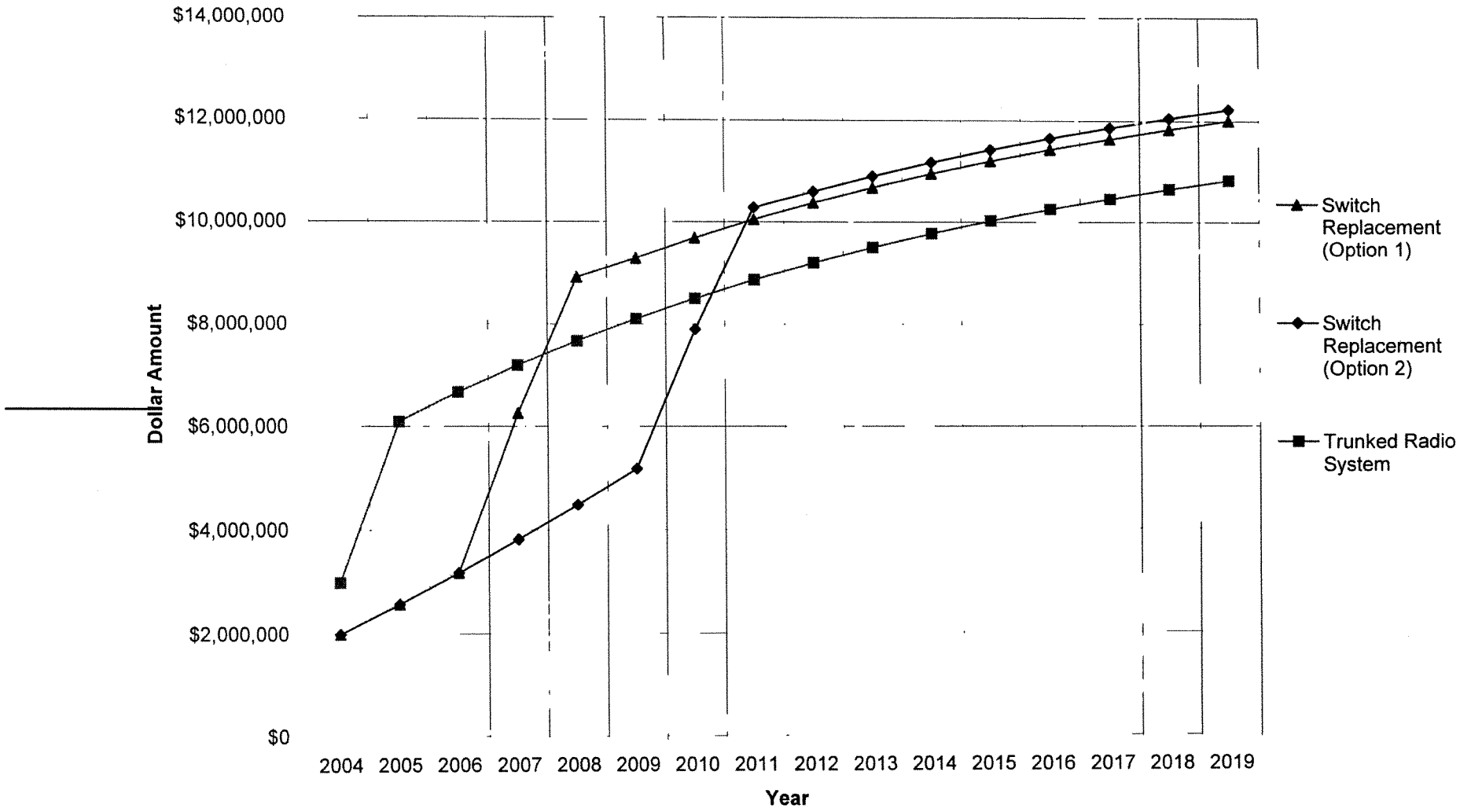
2012 It is estimated that the central switch would have a salvageable value of $35,439 (using a declining balance depreciation calculation at 30% per year).

2. Summary of O&M Costs for Switch Replacement

2004-2011 Due to the increasing age of the current system, the O&M costs were assumed to be the same as the Conventional Radio System in the first year and then increasing 15% per year for each subsequent year that the system is in service.

APPENDIX A.3

Comparison of VHF Mobile Radio Replacement Options



VHF Mobile Radio Replacement (Hydro Sole User)

Study Discount Rate: 9.60%

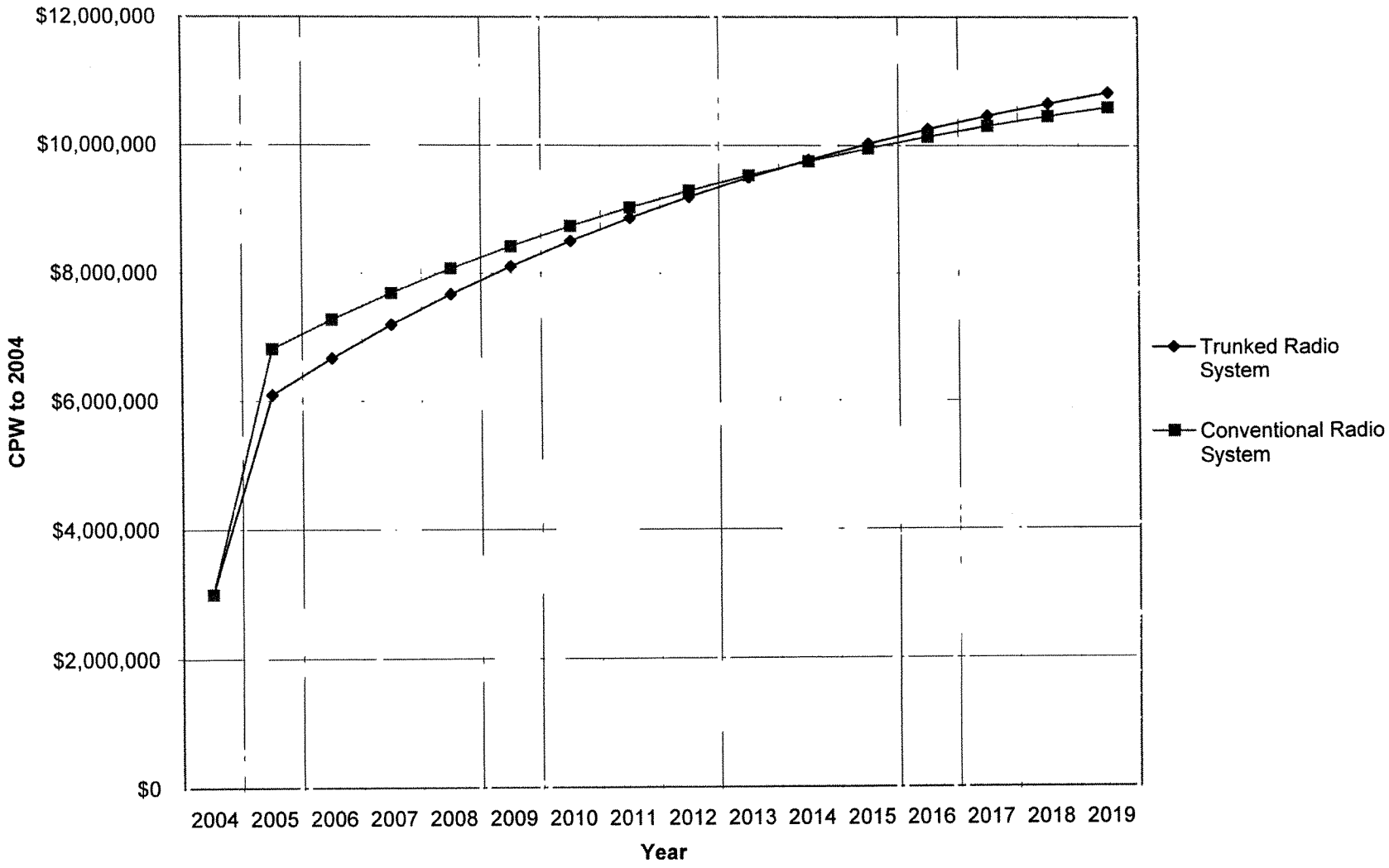
	Trunked Radio System				Conventional Radio System				NPV Comparison (Alt. 2 - Alt. 1)	
Year	Capital Costs	O&M Costs	Total	CPW to 2004	Capital Costs	O&M Costs	Total	CPW to 2004		CPW to 2004
2004	3,000,000		3,000,000	3,000,000	3,000,000		3,000,000	3,000,000	$	-
2005	2,700,000	689,250	3,389,250	6,092,381	3,625,000	551,250	4,176,250	6,810,447	$	718,066
2006		689,250	689,250	6,666,175		551,250	551,250	7,269,357	$	603,182
2007		689,250	689,250	7,189,709		551,250	551,250	7,688,071	$	498,361
2008		689,250	689,250	7,667,386		551,250	551,250	8,070,108	$	402,722
2009		689,250	689,250	8,103,223		551,250	551,250	8,418,683	$	315,460
2010		689,250	689,250	8,500,885		551,250	551,250	8,736,726	$	235,841
2011		689,250	689,250	8,863,715		551,250	551,250	9,026,910	$	163,196
2012		689,250	689,250	9,194,764		551,250	551,250	9,291,678	$	96,914
2013		689,250	689,250	9,496,816		551,250	551,250	9,533,254	$	36,438
2014		689,250	689,250	9,772,411		551,250	551,250	9,753,670	$	(18,741)
2015		689,250	689,250	10,023,866		551,250	551,250	9,954,779	$	(69,087)
2016		689,250	689,250	10,253,296		551,250	551,250	10,138,273	$	(115,023)
2017		689,250	689,250	10,462,630		551,250	551,250	10,305,695	$	(156,935)
2018		689,250	689,250	10,653,628		551,250	551,250	10,458,452	$	(195,176)
2019		689,250	689,250	10,827,896		551,250	551,250	10,597,828	$	(230,068)

Notes:

1. Trunked Radio System estimate based on figures used in Capital Job cost. Conventional Radio System estimate based on typical costs for a system of this nature.
2. Operations and Maintenance costs are assumed to be fixed for a 15 year contract with a third party supplier.
3. Maintenance costs for both systems are assumed to be identical.
4. 15 year life span of system assumed.
5. It is assumed that Hydro will be the sole user.

APPENDIX A.5

VHF Mobile Radio Replacemnt (Hydro Sole User)



VHF Mobile Radio Replacement (With WST Involvement)

Study Discount Rate: 9.60%

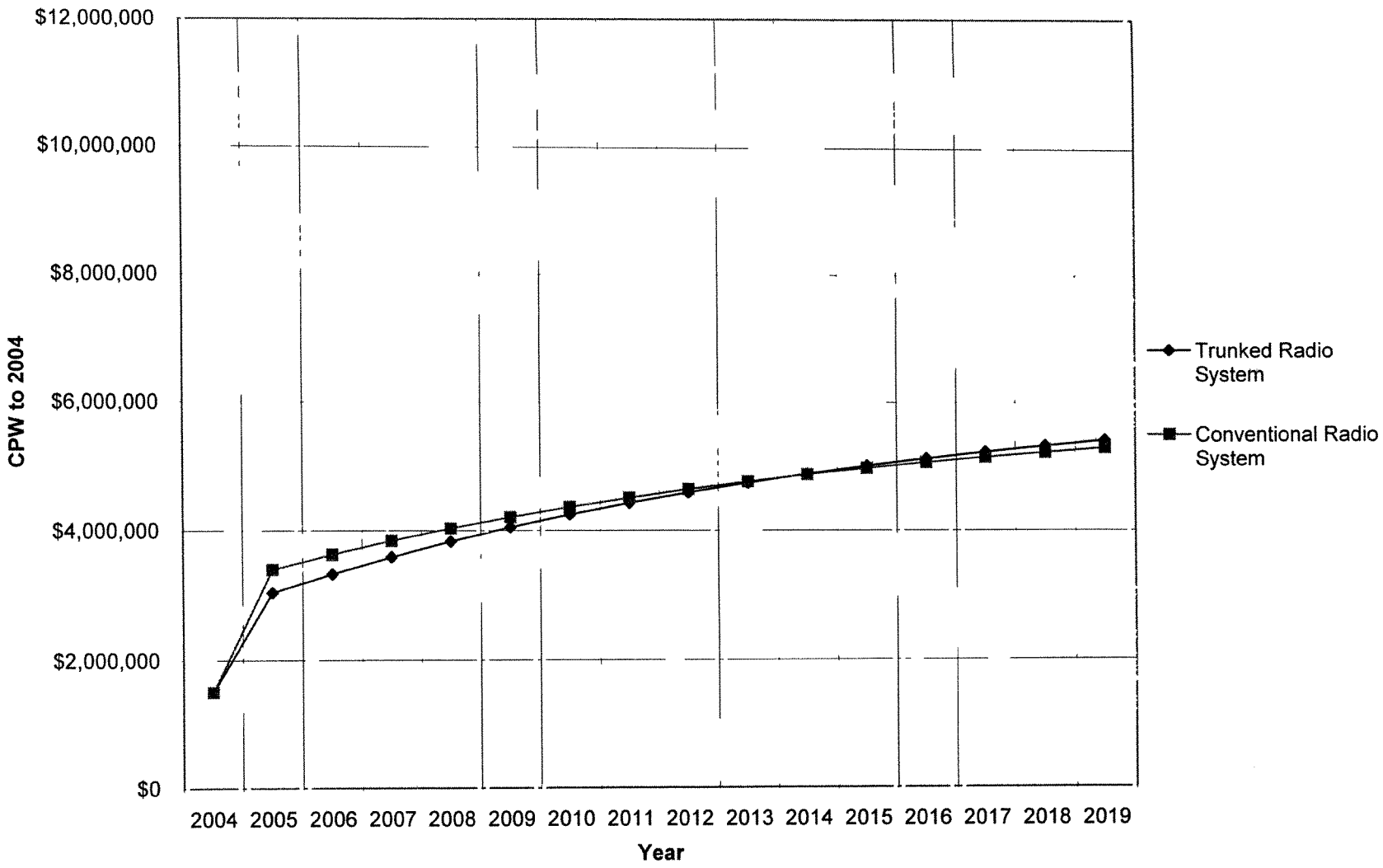
	Trunked Radio System				Conventional Radio System				NPV Comparison (Alt. 2 - Alt. 1)	
Year	Capital Costs	O&M Costs	Total	CPW to 2004	Capital Costs	O&M Costs	Total	CPW to 2004		CPW to 2004
2004	1,500,000		1,500,000	1,500,000	1,500,000		1,500,000	1,500,000	$	-
2005	1,350,000	344,625	1,694,625	3,046,191	1,812,500	275,625	2,088,125	3,405,224	$	359,033
2006		344,625	344,625	3,333,087		275,625	275,625	3,634,679	$	301,591
2007		344,625	344,625	3,594,855		275,625	275,625	3,844,035	$	249,181
2008		344,625	344,625	3,833,693		275,625	275,625	4,035,054	$	201,361
2009		344,625	344,625	4,051,612		275,625	275,625	4,209,342	$	157,730
2010		344,625	344,625	4,250,442		275,625	275,625	4,368,363	$	117,920
2011		344,625	344,625	4,431,857		275,625	275,625	4,513,455	$	81,598
2012		344,625	344,625	4,597,382		275,625	275,625	4,645,839	$	48,457
2013		344,625	344,625	4,748,408		275,625	275,625	4,766,627	$	18,219
2014		344,625	344,625	4,886,205		275,625	275,625	4,876,835	$	(9,371)
2015		344,625	344,625	5,011,933		275,625	275,625	4,977,390	$	(34,543)
2016		344,625	344,625	5,126,648		275,625	275,625	5,069,137	$	(57,511)
2017		344,625	344,625	5,231,315		275,625	275,625	5,152,847	$	(78,468)
2018		344,625	344,625	5,326,814		275,625	275,625	5,229,226	$	(97,588)
2019		344,625	344,625	5,413,948		275,625	275,625	5,298,914	$	(115,034)

Notes:

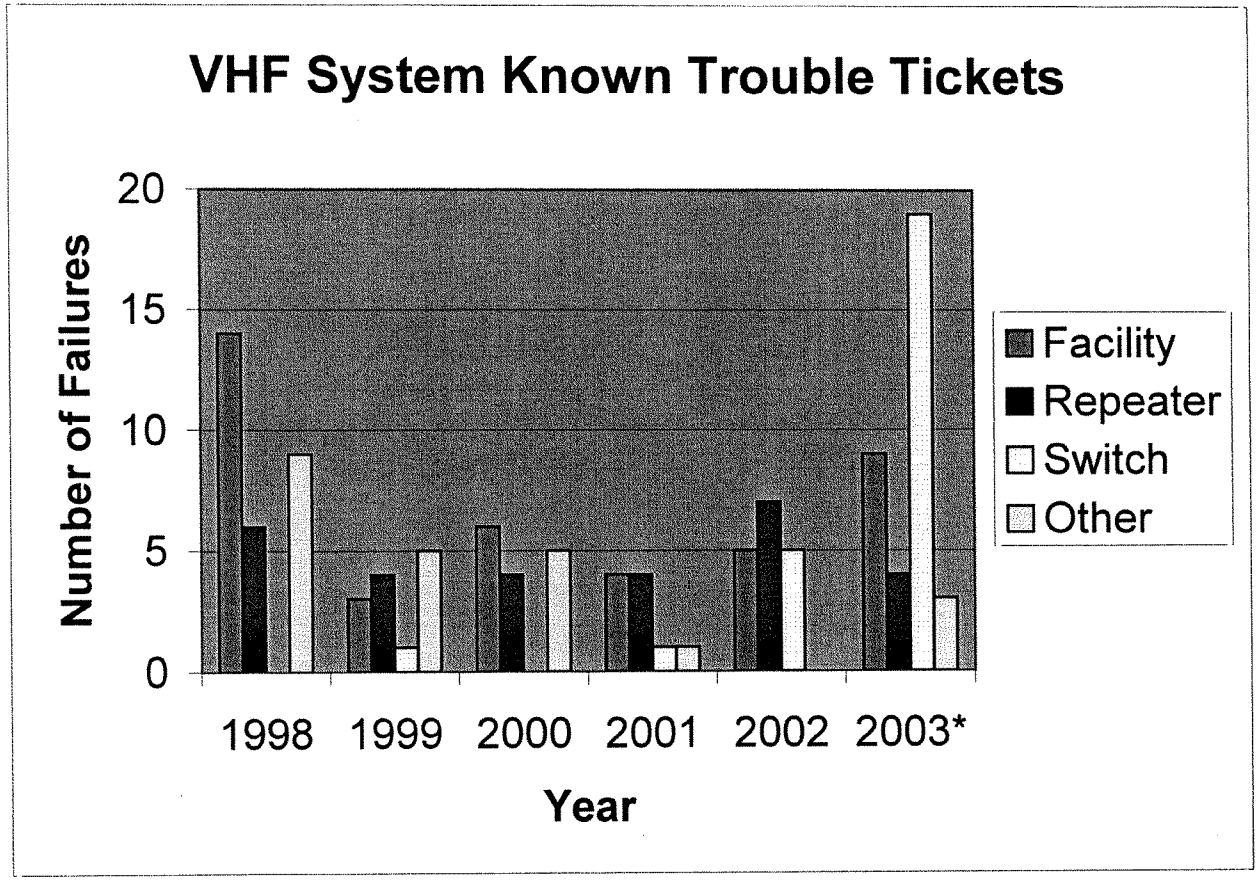
1. Trunked Radio System estimate based on figures used in Capital Job cost. Conventional Radio System estimate based on typical costs for a system of this nature.
2. Operations and Maintenance costs are assumed to be fixed for a 15 year contract with a third party supplier.
3. Maintenance costs for both systems are assumed to be identical.
4. 15 year life span of system assumed.
5. It is assumed that the Provincial Department of Works, Services, and Transportation (WST) contributes 50% of the costs of the system.

APPENDIX A.7

VHF Mobile Radio Replacemnt (With WST Involvement)



* 2003 represents two months (January and February)



APPENDIX B

MOBILE RADIO SURVEY - DECEMBER 2001

AREA		BC Hydro	Atco Elec.	Trans Alta	Sask Power	Manitoba Hydro	Hydro One	Hydro Quebec	NB Power	NS Power	Nfld. Hydro
Private System	1	Yes	Yes	Yes	Leased	Yes	Yes	Yes	Yes	Yes	Yes
Technology	2	Conv.	LTR	LTR	TRK	Conv.	Conv.	TRK/Con	NR	Conv.	Conv.
Frequency	3	VHF/UHF	VHF	VHF	800	VHF	VHF	VHF/800	VHF	VHF	VHF
Data	4	No	No	Yes	No	No	No	No	No	No	No
Cellular/Satellite	5	No	No	No	Yes (2)	Yes (2)	Yes (2)	No	Yes (2)	Yes (2)	Yes (2)
Consider Leased	6	Maybe	Note 1	No	Yes	No	Yes	No	Yes	Yes	No
Evaluation	7	Yes	No	No	No	Yes	No	No	In progress	In progress	No

NR - No Response

Questions:

1. Do you presently own and maintain a private mobile radio system?
2. Is the system best described as:
   (a) Conventional (b) Trunked (c) LTR - Logical Trunked Radio (d) Other
3. Is the system:
   (a) VHF (b) UHF (c) 800 MHz (d) Other
4. Is the system used to carry data? If yes, please describe the applications.
5. Does your utility use Cellular or Satellite phones for mission critical functions such a power switching, system restoral, etc?
6. Would your utility consider the use of a leased solution as the prime mobile radio system for mission critical functions?
7. Has your utility prepared an evaluation of the use of lease system versus a private system for mobile communications?

Notes:

1. Only if we (ATCO) had priority (last off, first on) and the service could be shown as reliable and economic as our own, and the right penalty clauses were in place.
2. All utilities using cellular or satellite phone do so to complement the coverage of the Mobile Radio System.

APPENDIX C

Technical Report
on the
Newfoundland & Labrador Hydro
Mobile & Radio Paging System Replacement
2001 February 26

The Reader is advised that pricing, included in this Report have been provided by suppliers on the understanding that information is treated as CONFIDENTIAL. Co-OPERATION of equipment suppliers, in providing accurate information, enables this Report to provide best estimate accuracies; it is, therefore, necessary for Readers to keep the pricing, contained herein, CONFIDENTIAL.

CONFIDENTIAL

Prepared for: Newfoundland & Labrador Hydro
Information Systems & Telecommunications

Prepared by: Norman Cook, P.Eng.

Date: 2001 February 26

File:NLHMORPT.COVER

TABLE of CONTENTS
FINAL REPORT

ATTACHMENTS

1 INTRODUCTION

The most important requirement of a mobile radio system is **Access. Access** is determined by two factors:

1. Geographical area coverage.
2. Adequate channel capacity to handle traffic.

This Report is prepared to summarize a study of the Newfoundland & Labrador Hydro ("NLH") Radio System (the "System"), in accordance with the **Tasks and Responsibilites - Section 2,** below, and to recommend the best method, based on available technology, to meet the existing, and future, operational needs of NLH.

The Writer is aware that discussions have been held with NewTel Mobility, to determine if there are any plans to implement a Province-wide mobile radio system, as exists in the other 3 Atlantic Provinces. With the Newfoundland & Labrador RCMP implementation of their own hybrid trunked mobile radio system, and with the RNC as the joint user, it is unlikely that NewTel will have enough anchor tenants to justify the infrastructure costs of a Province-wide trunked mobile system infrastructure. In all other Atlantic Provinces, the RCMP comprises a significant portion of anchor tenants.

The following **Sections 2 and 3** discuss the Tasks, Responsibilities, and Methodology used in the Study. **Section 4, 5, and 6,** the pros, and cons, of the various frequency bands, radio coverage, and existing peak site traffic, **Section 7,** the current and future operational requirements of the System, including supplementary coverage requirements, and **in Section 8** the alternatives, and associated costs of upgrades, meeting NLH requirements, are reviewed.

With the alternatives identified, estimates for these alternatives are prepared, comparing these alternatives in **Section 9.** Finally, **Sections 10,11, & 12,** summarize the results of the Study, and provide recommendations for subsequent decisions, and implementation.

A **List of References - Attachment 3,** is used throughout this Report, and referred to as a listed item number shown in square "[ ]", brackets following the related text.

Prior to the preparation of this Report, NLH had met with the Writer and identified the following current assessment:

> The existing mobile switch, manufactured by ATI, was placed in service in 1989, and with only a few in operation, spares are very difficult, if not, impossible, to

obtain.

Of the existing mobile and portable radios in inventory, most are in excess of their anticipated service life of 8-10 years.

In addition to selection of new sites in areas of coverage shortfall, the following coverage areas require particular attention:

The Great Northern Peninsula including the adjacent Labrador Coastline.

Happy Valley - Goose Bay area, if feasible to integrate with the Island portion.

The current joint operation of NLH, and WST, works well since seasonal peaks of each Agencies' activity occur at different times which, effectively, reduces repeater traffic conflicts - refer to **Traffic Data - Attachment 4**. The Great Northern Peninsula, however, has occasionally become somewhat congested, with NLH & WST joint usage.

Where possible, the needs of the existing co-user, Works, Services, & Transportation (WST), shall be integrated with replacement, if feasible; however, the priority is for NLH year 2002 implementation, with, or without, joint users.

Mobile radio network issues to be reviewed are as follows:

Review radio paging requirements and recommend a solution(s).

Review/identify mobile data requirements, for issuing switching and field orders, direct to mobile data terminal, MDT, operators via the current NLH AS400 Network (MDTs, which are ruggedized notebook computers, with floor mounted pedestals). This Report identifies network integration with the assistance of NLH Information Systems and Telecommunications ("IS&T").

Automatic Vehicle Location (AVL), which uses Geostationary Positioning Satellites for time/date stamping vehicular location data, to be available to the IS&T network users.

NLH indicated that a mobile repeater, to cover areas which may be too

remote for normal mobile repeaters to service, would be a valuable asset for remote construction, and repair, operations.

2. TASKS & RESPONSIBILITIES

2.1 General

The Scope of this Study is contained in this Section, and summarized, in the form of task responsibilities, as follows

2.2 NLH Responsibilities:

2.2.1 Compile Mobile traffic data from existing sites.

2.2.2 Identify existing NLH & third party sites used for existing coverage.

2.2.3 Identify existing sites which may be feasible for supplementary coverage to NLH owned sites, replacement for third party sites, or for areas where coverage does not exist. Sites shall be identified for access & hydro power status.

2.2.4 NLH shall arrange separate meetings with Works, Services, and transportation, and Newfoundland Power, to determine if there are advantages to share the new mobile network, especially with co-use of potential Newfoundland Power radio sites.

2.3 Writer Responsibilities:

2.3.1 Review availability of radio bands for a 10 year study life replacement NLH mobile radio system, including bandwidth availability in user equipment.

2.3.2 Review paging requirements and options, utilizing the mobile network if feasible.

2.3.3 Review NLH mobile data requirements, and GPS automatic vehicle location options for the NLH system.

2.3.4 Review NLH mobile radio system alternatives suitable for replacement of

existing system.

2.3.5 Prepare cost estimates of alternatives in 2.3.4, and include site costs, in accordance with coverage requirements identified in 2.2, above.

2.3.6 Present recommendations for the replacement mobile network.

3 METHODOLOGY

3.0 General

3.0.1 A preliminary meeting with the IS&T team provided the terms of reference, as described in **Section 2 - Tasks and Responsibilities**, above.

3.0.2 The first task is to define NLH coverage requirements, with the initial requirements determined from NLH in-house coverage maps prepared several years ago. The maps were reviewed within NLH to obtain a comfort level for the computer generated accuracy of the maps, based on the field experience of knowledgeable radio users, thereby providing the Writer with a more accurate assessment of existing coverage. Hence, with a better appreciation of actual coverage, additional sites were specified, and cost estimates of alternative technologies were completed to determine the preferred mobile replacement technology, and for the estimated number of existing & supplementary sites determined.

3.0.3 The various radio bands were assessed, within the terms of reference of mobile voice, data, growth, coverage capability, and for new, and future, equipment availability, and service life. Meetings with Industry Canada's Spectrum Management Section were held to assess which band is preferred, based on year 2000 NLH traffic measurements, and projected requirements.

3.0.4 Traffic data was reviewed to determine the number of repeaters which are needed at each site to serve the traffic activity of various mobile zones of operation. The quantity of repeaters are significant in the overall costs of alternative mobile technologies, since different technologies utilize different site equipment configurations.

3.0.5 Mobile data rate was determined based on the identified applications to be implemented over the 10 year study life. Data rate is an important consideration since each alternative mobile technology offers different data rate capability. A review of existing voice/data mobile networks was completed to determine if data was typically operated as a separate radio system, or could operate, in harmony with mobile voice.

3.0.6 An assessment of available, and NLH preferred paging technology, was then completed to define the preferred solution.

4 INDUSTRY CANADA FREQUENCY BANDS & POLICY

4.1 General

There are 3 frequency bands allocated by Industry Canada, for mobile radio use, including trunked radio systems, as follows:

1. VHF 150 MHZ - Existing System
2. UHF 450 MHZ
3. UHF 850 MHZ

Table A, below, lists a summary of advantages, and disadvantages, of the frequency bands', 150, 450, & 850 MHz parameters.

Table A.

Freq. Band	Coverage	Radio Cost	Dispatch	Expansion	Software	Replacement
150 conv.	Best area & range from repeater	Not expensive	Not expensive	Urban channels unavailable	Minimum need, if any	Multi supplier availability
450 conv.	Less area/range than VHF	Approx VHF +10%	Same as VHF	Urban channels available	Same as VHF	Same as VHF. TETRA radios are in this band.
LTR 150 or 450	Same as above	Not expensive	Same as above.	Same as above.	Dispatch, mobiles, and repeaters	Multi supplier availability.
850 trunk	Same line of site mobile coverage as 450 but improved portable coverage in malls, & metal clad buildings with small windows	Expensive	Expensive	Additional channel availability virtually unlimited	Regular upgrades required	Current sole source supplier, except for LTR which has multi source radio availability

4.2 Industry Canada Policy

In a January 2001 meeting with Industry Canada, the mobile replacement plan was discussed to determine any licensing policy issues which might affect selection of the preferred band, radio bandwidth, or policies relating to joint use of, not only the mobile radio network, but the microwave backhaul facility, since microwave is an integral part of mobile radio services. Industry Canada was requested to respond advising of any issues to be considered, for NLH joint use expansion plans.

Another important consideration for continued use of the 150 MHZ band, in the Avalon area, near St. John's, is that future growth in VHF channel capacity may not be possible, due to the saturation of this band's use. Growth of channels in the greater St. John's area is critical to the decision to operate in VHF mode, even though the benefit of VHF band Province-wide operation is significant due to provisioning of 30 % more sites in the 450 MHz & 850 MHz bands (the 450 MHz and 850 MHz bands exhibit essentially the same coverage area) - refer to **Attachment 1 - Radio Coverage comparison.**

Another issue, discussed with Industry Canada, for retention of the VHF band is the progress of narrow band equipment from 25 kHZ to 12.5 kHz, and further reduction to 7.5 Khz; however, mobile data rates for the narrow band radios would be reduced as well, for a given modulation scheme. Selection of minimum mobile data rate within NLH for the next 10 years is, therefore, critical.

5 RADIO COVERAGE

5.1 General

Discussion, in this Section, applies whether the radio is conventional, or trunked, except that, as a rule of thumb, trunked radios operating in the digital mode, exhibits reduced coverage from that of trunked systems operating in analogue mode. Initial discussions indicate that NLH does not require voice privacy, which avoids problems of varying coverage (from 0.5 to 5km range) when a radio is switched from analogue to digital.

The existing 150 MHZ band is the best for radio coverage exhibiting about a 30% increase in coverage area compared with 450 MHz & 850 MHz, and requiring less sites to cover a specific area - refer to **Attachment 1 - Radio Coverage Comparison.**

The 850 MHZ band has only about 1/3 the simplex range of a 150 MHz, or 450 MHz radios in dense forested areas, primarily die to clutter loss, and licensed output power, of this band. The 850 MHZ band exhibits superior portable repeater reception (talkout) performance because of an empirically observed lower body loss, and also exhibits better penetration into buildings which are of metal construction having small windows, which are common characteristics of warehouses, and places such as malls which have several embedded corridors, and storage areas. Whichever band is chosen for urban use, rf amplifiers are generally used to improve coverage in urban structures, such as malls.

The ability of a trunked radio to switch sites ('handoff automatically') to adjacent

base/repeater provides a 'virtual' better coverage to an inexperienced, or infrequent, radio user, who is not familiar with the geographical channel switching points for adjacent sites.

It is important for the reader to be aware that no frequency band provides 100% radio coverage, rather, systems are generally designed for 90% area coverage, for 90% of the time, and 90% of location (both time & location being randomly selected) **[2]**. The objectives for public safety are 95% of time and location, however these objectives are seldom met in the Atlantic Provinces due to availability of infrastructure funding to achieve 95% area coverage.

5.2 Coverage Criteria

5.2.1 Paging

5.2.1.1 Digital (Alpha-numeric) Paging

The technical criteria for alpha-numeric paging coverage, is the range at which the Bit Error Rate (BER) does not exceed a specified value. For example, the MTT pager, Motorola Advisor Gold requires field strength of 5uV/m (512bps) to 10uV/m (2400bps); the PerComm Model PA8002, requires an analogue field strength level of 5 uV/m (512 bps), to 7 uV/m (1200 bps). Hence, for maximum range, the data rate should be reduced. Body loss is a significant factor for 150 MHz & 450 MHz band paging.

5.2.1.2 Analogue (Tone & Voice) Paging

Same criteria as analogue mobile, see 5.2.2, below.

5.2.2 Analogue Mobile Criteria

In public safety mobile radio systems, the acceptable coverage range, or boundary, is defined [2], where voice quality is subjectively described as follows:

"Speech understandable with repetition only rarely required. Some Noise/Distortion" This is technically referred to as Delivered Audio Quality (DAQ) of 3.4, which is a figure of merit used in the industry.

In practice, the above is too costly to achieve, and the following subjective description criteria is accepted as suitable:

"Speech is understandable with slight effort. Occasional repetition required due to Noise/Distortion" This is technically referred to as DAQ of 3.

5.2.3 Path Variations

Because of the larger mobile antenna, and greater mobile transmit power; the repeater talk-out signal exhibits greater range of transmission than the mobile transmitter talk-back range to the repeater. The excess repeater talk-out power (125w ERP max allowed for 150 MHz) is required to activate reception of the belt mounted portable which experiences an additional 17 dB of (body) attenuation for VHF radio frequencies, and less body attenuation as the frequency band increases; once the portable is raised to head level for talk-back response to the repeater, the body loss attenuation reduces to a lessor level (head attenuation) hence increasing the talk-back range of the portable. This demonstrates the elusive user concept of coverage.

5.3 Radio Design Criteria

As in the Introduction, Access is the single most important objective, regardless of which features are added.

Radio coverage is usually reviewed by a well established computer prediction model, which has proven industry accuracy in the telecommunications industry for about 20 years. The computer prediction model provides for radio coverage changes based on seasonal weather activity, and facilitates plotting of coverage areas on standard topographic, or other scaled, maps. The prediction model is suitable for remote wide area predictions, unfortunately there is no model available for predicting coverage inside complex structures in an urban area, or areas such as inside the Holyrood Thermal Generating Plant, since steel and concrete structures play havoc with computer modeling variables. Urban coverage must be dealt with on a case by case basis, and after the basic system is installed.

This Report is permitted neither the time, nor the scope, to prepare coverage predictions of existing, or alternate sites. Data previously completed within NLH is used, and supplemented with best guesstimates, in order to provide the basic system configuration,

required to prepare estimates for the quantity of sites estimated.

The channel capacity of a radio system is critical when a local 'incident specific' situation which is serviced by a single site, becomes heavily accessed by radios, for example, the situation on the Great Northern Peninsula, where there are times when NLH as well as WST are trying to access the limited repeater resource, will be addressed in this Report's configuration, and cost estimates. This could also occur if a large construction project is being completed adjacent to a site used for daily operational radio traffic.

The amount of voice traffic anticipated under the specific incident will determine whether a single radio voice channel, or multiple channels are required at a remote site. The existing system, for the most part, has operated successfully, in the past while being shared with the Dept. Of Works, Services, & Transportation. Any expansion to other users will inevitably, if not initially, require additional repeaters at high traffic sites, therefore necessitating the provisioning of a suitable sized switch to handle additional repeaters. For purposes of this Draft report, the new microwave system is anticipated adequate to handle the backhaul capacity of future growth.

Secondary, other operationally important issues are also addressed as part of technology review, include the following:

1. Ease of radio use - physical, and technical.
2. Durability of radios for work environment (i.e. US MIL Spec. Standards).
3. Initial, and ongoing equipment costs.
4. System user training needs.
5. System maintenance service provider minimum requirements.
6. Planned obsolescence of selected technology through support.

5.4 Simplex (talkaround) Operation in the 850 MHz Band

The latest Motorola Mobile Trunking System is called **SmartZone^{SM} (SZ)** in this System the trunking control channel cannot be used for voice - initially, all remote sites, in **SZ** will provide a minimum of 1 control, and 2 voice channels. If simplex channel mode is provided for to reduce traffic on a repeater, and keeping in mind that an 800 MHZ simplex radio, has only about 1/3 the line of site range as VHF, **making the 850 MHz equipment undesirable for local site communications beyond an approximate distance of 2 km (less in highly treed areas).**

6 EXISTING RADIO SYSTEM & ALTERNATIVES

6.1 Paging System Description

6.1.1 NLH utilizes an analogue tone & voice system having transmitters independent from the mobile system.

6.1.2 Two types of paging systems are available, as follows:

6.1.2.1 Tone & Voice analogue paging (same as NLH existing).

Tone & Voice pagers are becoming obsolete; however, they have the advantage of encoders which use mobile repeaters, as paging transmitters. Many T & V users find that they can use the pager as monitors for the repeaters transmitted mobile voice signal as well. Some agencies do not condone this use of pagers as a simple form of 'scanner', i.e. as in the volunteer organizations. NLH's existing paging system is independent of the mobile system, thereby having a backup communications system, albeit one-way.

6.1.3.2 Alpha-numeric digital paging.

Alpha-numeric paging requires 'digital ready' transmitters, or transmitters which have either FSK or have a true FM modulator (response down to DC), and with minimum rise time of 250 us for reliable POCSAG code operation. There are adapter kits which claim to adapt analogue transmitters for digital paging, however this is not recommended unless more investigation to assess known operating systems using this approach.

Digital (alpha-numeric) pagers are approximately 1/3 the cost of T & V pagers.

6.2 Paging System Selection

6.2.1 Selection of a paging transmitter to carry alphanumeric format paging is more critical than for analogue tone & voice due to the requirement for fast transmitter rise times (i.e. wider bandwidth)

for the digital signals.

6.2.2 The Writer is aware of one manufacturer, **Multitone**, who provides a multi- format paging system which can be configured for most paging formats required.
Outputs of this particular model can be zoned with different paging formats based on groups of transmitters, or coverage areas.

6.2.3 Highlight Comparisons of Paging Systems, are summarized in **Table B,** following:

Table B

Feature	Encoder		Transmitter, Unit $		Pager, Qty $	
Pager Type	T & V	Alpha-Numeric	T & V	Alpha-N	T & V	Alpha-N
Message	Tone Sequence Voice	Digital	Standard	Digital Ready	Audio	Display 1 - 4 Lines
Message Storage	NA	NA	NA	NA	Some	Many
Time/Date Stamp	NA	NA	NA	NA	No	Yes
Cost	Attach 5	Attach 5	$ 5,000	$ 40,000	$ 450	$ 150
Package Media	Desktop, EIA Rack	Desktop, EIA Rack	Stand alone, EIA	Stand alone, EIA	Audio	Small Characters
Size	NA	NA	NA	NA	Med.	Small

6.3 Mobile Radio

6.3.1 Review of the existing NLH Multi Department Mobile Radio System Description [1], indicates that it is trunking system, with the exception that a single repeater is employed at each site. Although this defeats the concept of trunking, the system has the necessary features to operate with a central switch (the Gander ATI Switch), and to perform the necessary

telephone interface functions which are available on all the trunked systems being considered as alternatives.

The alternative trunked radio networks to be compared, and considered for replacement, are briefly, as follows.

6.3.2 The TETRA digital trunked radio network, an open standard, multi mobile supplier European Digital System. Beginning introduction in Canada, with the nearest supplier in Halifax, NS.

6.3.3 The ComNet Ericsson's EDACS analogue/digital trunked radio proprietary network. Province-wide systems exist in Canada, and having locally supported equipment.

6.3.4 The Motorola SmartZone analogue/digital trunked radio proprietary network. Province-wide systems exist in Canada, and having locally supported equipment.

6.3.5 The E.F. Johnson LTR radio system is also an open system for which several vendors can supply radio equipment. Several systems exist in North America, having local service support. In Newfoundland & Labrador, a supplier, or NLH, would require technical training on the LTR Network.

6.4 Current User Equipment Quantities

6.4.1 General

Existing radio system assessment is provided in **Attachment 2 - Radio Equipment List**, to complete user equipment quantities in order to select the suitable model radio/pager, and to assign appropriate cost estimates, which are model dependent. For example, an model equipped with a data port, and automatic vehicle location features will be more costly than a basic model which is best for many user tasks.

6.4.2 Pagers

Existing pagers are analogue T&V type, with an independent

infrastructure, which includes dedicated transmitters. Quantities are shown with mobile equipment quantities in **Attachment 2 - Radio Distribution List**.

6.4.3 Mobile

The **Attachment 4 - Radio Distribution List**, is supplied from current records, and is the starting point for radio equipment replacement estimates

The generally accepted mobile telecommunications equipment service lives are considered as follows, and provided that manufacturer continues product support:

Fixed Equipment	12-15 years	
Mobile Radios	10 years	
Portable Radios	8 years	(batteries 2-4 years for 8 hr. shifts 5-5-90 duty cycle)

The above equipment lives apply to conventional radio equipment; in the final economic analysis it may be necessary to reduce the lives of programmable equipment, such as trunked radios, because of the rapid changes technology undergoes. User equipment service life is critical to economic analysis since replacement capital injection may be required sooner, or more frequent, in the economic model, compared with conventional equipment replacement. Care must be taken in planning for trunked radio service lives with the rapid change in technology. Trunked systems require mandatory software upgrades, in most cases, are required to keep manufacturer warranties effective. The best protection to avoid obsolescence during our 10 year service life is to define, and to specify, in detail, the manufacturer/supplier conditions up front, in the Specifications/Contracts.

7 EXISTING AND FUTURE OPERATIONAL REQUIREMENTS

This Section discusses existing, and future, operational requirements of NLH.

Since radio access, which includes coverage and voice channel loading, is the most important requirement of any radio system, these requirements are discussed, in this Section, before the other issues.

7.1 Existing Requirements

7.1.1 Radio coverage.

7.1.1.1 Existing coverage requirements do not meet the area encompassed by NLH [9], and in malls where VHF coverage has been a problem. Since paging is the limiting factor in achieving good wireless coverage (due to the lack of good antenna and hip location on the body, resulting in reduced effective receiver sensitivity); if paging coverage is met by selection of a specific site, then portable coverage should be adequate. Review of NLH paging coverage identifies sites adequate for NLH's mobile/portable radio coverage.

7.1.2 Radio Access

7.1.2.1 Existing traffic data, and NLH feedback indicates that previous repeater access problems with W,S, & T have been resolved, with the exception of the Great Northern Peninsula, GNP, where some improvements could be made to augment the needs on the GNP.

The Labrador south shore shall be included as an area to augment coverage on the GNP.

7.2 Future Requirements

7.2.0 Site Traffic Capacity

A review of the existing traffic on peak usage sites is found in **Attachment 4- Traffic Data**. Results show the complimentary seasonal site activity of NLH and

W,S, & T radio usage. Unless other user(s) are considered for joint system usage, there should not be a need for expansion of repeaters other than site additions required for radio coverage. A few sites could improve call queue time for access improvement, fortunately, Kenmount Hill traffic peaks at only 50% of the traffic of some of the network's busier sites; this is critical since Kenmount would be the most difficult site to obtain approval for an additional VHF frequency pair license.

7.2.1 Physical Size of User Equipment

Recent technology has reduced physical size, and weight of pagers and portable radios; it will be necessary, prior to going to Tender, for Department operations personnel to have a 'hands on' exposure to various models to determine if the smaller physical radio sizes do not cause a problem for the radio user, especially while using heavy gloves, or having other apparel, required by the radio user tasks. Some recent field trials have reported difficulty of some pager users to read the small 4 line text displays.

7.2.2 Mobile Data

Physically, an RS232 port is found on LTR, EDACS, and TETRA, mobile radio, with TETRA having an equivalent port on its portable radios. The port is duplicated at the dispatch end, or some suitable terminating PC on the Mobile data networks, require a processor which operates independently of the voice trunked switch, and somewhat like a router (Data Controller) - refer to **Attachment 12 - Dedicated Data System Block Diagram**. The Data Controller is an option on TETRA, and EDACS, which assigns an IP address to each mobile. The Data Controller would provide the necessary interface with the NLH AS400 Network. EDACS currently offers the data 'router' in only TCP/IP protocol.

The future major application of mobile data is anticipated to be email access, with field orders being attached as in normal email applications. It is anticipated that this application would find that the mobile user requiring higher speed data rates approaching those available to home computers, these data rates are only becoming available on such European Trunked Radio Networks such as TETRA, which is beginning to appear in North America now (data rates typically 28.8 kbps = 19.2 kbps throughput) approx 30 % throughput reduction results from the integrity of forward error correction code - FEC, and protocol bits). The Writer

feels that 2 kbps throughput is sufficient for brief text based email services, as for filling of form masks in MDTs (provided, of course, that the system is not misused, as experienced initially for voice communications, when operators were not made aware of the limited time resource available for unnecessary wireless voice communication!). Mobile data connection, limited to the NLH AS400 Server, would limit use to work related text activity. NLH may want to limit mobile data to Corporate use only, and not extend use to W,S, & T, unless the feature was proven to reduce access time resources.

For operational requirements, such as issuance of field orders, the data transfer can be greatly reduced by having any common form resident on the MDT, and just transmitting the data required to 'fill in the blanks', requiring mobile software data development.

If transmission of graphics is required, it will be necessary to select the higher speed mobile data systems initially, to avoid future 'growing pains' and associated expenses.

Some public safety first responder agencies use a redundant mobile data on the Cellular Digital Packet Data (CDPD) network for redundancy. CDPD operates at a 19.2 kbps (throughput approx 12 kbps) and is currently found to be an expensive service.

7.2.3 GPS Automatic Vehicle Location (AVL)

Geostationary Positioning Satellite data is an application of low speed mobile data, requiring a GPS receiver added to the radio data port. This option is available from radio suppliers, or may be third party units. One supplier adds the option for about $1000 for each mobile. GPS data is usually superimposed on applications software, such as topographic, and municipal maps, on a desktop PC, for Computer Aided Dispatch operations.

7.2.4 Portable Repeater

The EDACS alternative suppliers a mobile repeater option. In addition, third party mobile repeaters are currently being developed for trunking systems requiring trunked system access to conventional systems. RF repeaters are also used to improve coverage in urban areas such as malls.

8 RADIO SYSTEM ALTERNATIVES

8.1 Paging

The older Tone and Voice (T&V) Pager is becoming replaced with Alpha-numeric digital pagers. An advantage of T&V pagers is that they can use any existing mobile transmitter and can be used to monitor voice on the repeater talkout channel, however the T&V pager is expensive ($450.00/ea. In large quantities compared with $150/ea. for alpha-numeric pagers).

A disadvantage users find with Alpha-numeric pagers is the size of the display, some pagers offer a zoom feature to overcome this problem.

This Report focuses on the application of the alpha numeric pager since they have features that include the following:

8.1.1 Avoids the problem of missed voice syllables, or need to repeat voice messages.

8.1.2 Information remains in the pager until cleared by the user, avoiding missed messages, or enabling recall of messages.

8.1.3 Permits use of vibrating alert, avoiding the need for user to turn it off under certain private meetings, or appointments, for etiquette reasons.

8.1.4 Features Time/date stamping of incoming information.

8.1.5 Memory backup prevents loss of messages if battery fails.

8.1.6 Backlit displays for reading recalled messages at night.

8.1.7 Messages can contain more instructions due to memory capacity of pager; messages can also be stacked until cleared by user.

Paging allows maximum user access for the dollar spent. A disadvantage with one-way paging is that the dispatcher does not have confirmation that the page had been received. Paging coverage is less than portable coverage due to the body loss observed with the pager's reduced receive signal, and typical belt mount location on the body.

8.2 Mobile Radio

This Section briefly describes the configuration of the following 4 alternatives:

.1 TETRA - European Digital Trunked Open Standard Radio System.

.2 Motorola SmartZone[SM] Trunked Radio System.

.2 ComNet Ericsson EDACS[SM] Trunked Radio System.

.3 LTR[SM] Trunked Radio System.

Estimates are prepared, and economically compared in the next **Section 9 - Cost Estimates of Alternatives & Assumptions.**

LTR[SM] is an open system trunking standard, originally introduced by Transcrypt (formerly E.F. Johnson). Many radio suppliers make compatible user equipment.

The remainder of this Report will analyze the latter factors towards recommending the diligent choice of technology for NLH.

The above alternative radio system configurations, available to meet the radio requirements of NLH, are now discussed in more detail.

8.3 Generic Trunked Mobile Radio System

8.3.1 General

During Report preparation of the **Attachments 6 through 10**, which are Block Diagrams of the Existing, and Trunked Mobile Radio System (TMRS) Alternatives being considered as replacements can be represented by a generic trunked radio network since they function similarly.

The existing NLH mobile radio system is a TMRS, except that there is only one repeater at each site, thereby not meeting the basic requirement for a TMRS. All TMRSs have the capability to interface with either a Private Branch Exchange

(PBX), or the existing Public Switched Telephone Network (PSTN). The ATI switch, is simply the 'Redundant Switch, or Controller" shown in all the alternative Trunked Mobile Radio (TMR) Networks. Features contained in the existing TMRS allow interconnection with a PBX, or the PSTN.

Its interesting to note that the existing TMRS is also data capable, except that the MDMRS Console Workstation Operator (CWS) must set up the mode manually, unlike the new replacement alternatives discussed in this Report.

All trunked radio systems can be hybridized with conventional radio systems. A proprietary system, such as Motorola SmartNet[SM], SmartZone[SM], or ComNet Ericsson EDACS, and TETRA interfaces with conventional through a console patch; the conventional channel is represented by an icon on the console PC display, and is simply 'affiliated', by dispatch operator software, with the trunked system talkgroup which is also a display icon. A more sophisticated, and expensive, infrastructure, is required for proprietary trunked systems.

The Hybrid Conventional/Trunked Mobile Radio System provides for an easy transition to Logic Trunked Radio (LTR), which is an economical trunked radio system. LTR has the necessary features, and multi supplier sources, to enable competitive tendering of equipment throughout the service life (Section 6, above). The LTR also has low speed data port with selected mobile radio models. LTR & EDACS trunked systems utilizes a control channel which can also be used for voice communications.

Configuring the conventional system to an LTR radio system requires simply the addition of a controller at the repeater site, acquisition of the necessary number of repeaters for voice/data traffic expansion needs, acquisition of LTR compatible mobiles and portables, acquisition of a compatible LTR dispatch computer software, and programming of the system to function as a trunked radio system, complete with talkgroups.

There are 2 major trunked radio systems currently operating in Canada, and the United States, as follows:

.1 Motorola SmartNet[SM]/SmartZone[SM] System
- used in Nova Scotia Province-wide by NLH & the Province, NLH, respectively; also Manitoba.

.2 ComNet Ericsson EDACS System

- used in British Columbia, Saskatchewan, Ottawa-Carlton, Newfoundland Province-wide by RCMP & RNC

Both systems above are proprietary, the ComNet Ericsson utilizes their radios only. Motorola SmartZone[SM] Radios can be second sourced, but user capability may be limited unless negotiated prior to final contract signing, and may be non-negotiable if the user want to add specific features, including software upgrades, later in the radio service Contract.

The decision for selection of the desired configuration is based on the relative operational features, and cost of acquisition and maintenance. Both Motorola SmartZone[SM], and ComNet Ericsson EDACS[SM] utilize expensive central trunking switches, both systems have features generic to trunked radio systems. Both systems utilize a control channel at each site. The Motorola control channel is dedicated for site control, a minimum of 2 additional voice channels are usually provided at each site; EDACS[SM] can utilize the control channel as a voice channel. The EDACS[SM] dual use of the control channel permits remote, low usage sites, to be trunking configured, with features such as roaming, while only requiring a single channel.

Because of the high cost of a central switch for each proprietary trunked radio system, application of these systems is usually confined to province, or city, -wide usage with more than one user group sharing the cost of the infrastructure.

There are 2 major European trunked radio systems beginning to make inroads to the North American market, but introduction is slow, and support is sparsely located across North America. These systems are known as MPT 1327 (a mature analogue system of about 12 years), and TETRA (a major digital trunking system, plans for penetration in Canada/US end 2001); both of these European systems are open architecture configured with closely monitored evolution by an independent agency, resulting in multi suppliers, hence, more competition, and less cost of user equipment.

The MPT 1327 has not been considered in this Report, primarily due to the lack of support services in Atlantic Canada.

9 Cost Estimates of Alternatives & Assumptions

9.1 Radio Paging

This Section lists the configuration, and associated costs - refer to **Attachment 5 - Cost Estimates**, showing the paging alternatives considered, as follows:

9.1.1 Tone & Voice Paging - refer to **Attachment 11.**

9.1.2 Alpha Numeric (POCSAG) Paging - refer to **Attachment 11.**

During the writing of this Report a dual function paging system, developed in the UK and currently used in Canada, was reviewed. The advantage of this Multitone Access 3000 system is that it offers T & V, as well as alphanumeric paging utilizing standard transmitters in a proprietary format. The encoder can also provide standard T & V paging, as well as the standard POCSAG alphanumeric paging. This dual function paging system is included for the paging cost estimates in Attachment 5.

9.2 Mobile Radio

This Section lists the configuration, and associated costs - refer to **Attachment 5** showing trunked mobile radio alternatives considered, as follows:

9.2.1 TETRA[SM] Digital Trunked System - refer to **Attachment 7.**

9.2.2 Logic Trunked Radio LTR[SM] - refer to **Attachment 8.**

9.2.3 Motorola SmartZone[SM] Trunked Radio System - refer to **Attachment 9.**

9.2.1 ComNet Ericsson EDACS[SM] - refer to **Attachment 10.**

9.3 Assumptions

9.3.1 The following assumptions are used in the completion of cost estimates for the above alternatives:

9.3.1.1 Terrestrial links (backhaul) shall be considered as having adequate capacity at NLH owned sites. Where NLH must use third party sites, either rented lines, or radio links shall be provided by NLH to the nearest interface point to NLH's microwave network, including the new Eastern portion. Costs for all backhaul facilities are not included in this Report.

9.3.1.2 The system design shall provide for alarm circuits to each radio site to report any major, and minor alarms to a 7/24 monitored alarm center. The existing NLH 7/24 center would be the logical location for having all mobile radio network alarms to appear. In general, trunking systems have ports available for network alarms, which may be in standard SNMP protocol format, or operating on standard MicroSoft Windows NT; alternately the local microwave alarm system can be utilized for available mobile equipment major & minor alarms. Central alarm equipment is considered NLH supplied.

9.3.1.3 Existing & new NLH primary radio sites, required for necessary mobile coverage, and third party supplementary coverage sites, can facilitate the following mobile radio infrastructure requirements:

- Adequate floor space for mobile/paging equipment, and associated equipment, such as space for equipment links to third party adjacent sites.
- Adequate power from the primary power source, and necessary backup time in supplementary power sources.
- Towers sufficient to meet CSA S37 tower loading requirements, and provisioning to ensure that third party towers are capable of meeting the same requirements.
- Provisioning for the necessary site access of NLH, and third party sites, to meet the standby power requirements

for extended prime power outages.

- Coverage areas, on which the number of repeater sites are determined for cost estimates is based on maps which are not fully confirmed in the field. These maps are assumed for estimate preparation for this Study.

- The middle cost radio model (tier) is used in estimate preparation. Features of trunking radios are very dependent upon the model used, with significant pricing variations.

9.3.1.4 It is unlikely that the future addition of Labrador sites will require an addition to the central mobile switch, since Labrador requires special mountain top repeater configurations which are design to work with the low availability of power available at these sites.

Labrador mobile solutions require a separate design philosophy than the Island portion found in **Attachment 5 - Cost Estimates.**

10 Conclusions

Paging

10.1 General

This Section discusses the most cost effective alternative for **paging**, and with consideration to the relative merits, and demerits, of the features.

10.1.1 NLH must determine the user/operations preferred method of paging; this can be achieved with a local evaluation field trial on an existing digital paging network, and using a 4 line digital pager, preferably with a display zoom feature. The zoom feature is required for many users who have difficulty reading small font messages, on the typical small pager packaging size.

10.1.2 The costs of alphanumeric pagers are 1/3 that of T&V pagers, and many features are desirable operationally, such as time/date message stamping (POCSAG standard). The down side is that digital paging transmitters are more expensive, including a requirement for more antenna filtering at

sites shared with other analogue radios (i.e. mobile). **Attachment 5, Sheet 2.** Use of a third party Province-wide paging network, and digital pagers is the most cost effective way to proceed.

10.1.3 It is apparent that the cost of existing, or new, infrastructure required to operate the relatively small number of paging receivers (Qty = 47), used within NLH, is not justified. It would be more beneficial to provision an additional mobile radio transmitter for each site, replacing the paging transmitter, and providing a portable radio in place of pagers for each existing paging system user. The latter configuration provides the site equipment redundancy presently achieved by the existing separate paging transmitter existing at each site now.

Mobile

10.2 General

10.2.1 **Detailed Cost Estimates - Attachment 5,** were prepared for each of the 4 available trunked radio systems.

10.2.1 Tendering generally drops the costs used for preparing estimates; a reduction of 25 % can be expected in the normal tendering process; however there are unknown factors, arising from assumptions which dictate leaving the estimates as they are for alternative selection purposes.

10.2.3 Forthcoming negotiations, following a Memorandum of Understanding that the Dept. Of Works, Services, & Transportation (W,S, &T) plan to continue with a modified joint use arrangement with NLH, with some coverage expansion, means that the VHF band is preferred, unless significant future traffic increases are identified. W,S, & T has indicated that they may add an approximately 100, currently simplex, radios to the NLH network. NLH must review the areas in which these additional radios are located, to assess the repeater traffic loading impact.

10.2.4 Further to 10.2.3 above, if future join users are considered by NLH, especially in core, or high radio traffic areas, any new service equipment may be isolated from NLH by placement on any frequency band; while this option does not grow the core NLH/WST Network in an optimized trunking manner, it does provide for NLH revenue, utilizing the infrastructure, since the infrastructure is frequency independent, with the

exception of requiring the repeaters to be the band of the user equipment (i.e. mobiles, portables).

10.2.5 Implementation with the LTR open system trunked radio system, will permit reuse of existing transmitters, utilizing the Zetron Model 452/459 repeater controller. This will provide for the most cost effective solution, while maintaining a solution which is supported by a multi-supplier user equipment source of radios which operate in both the narrow band 12.5 kHz, and existing band 25 kHz VHF frequencies. Repeaters which meet the new narrow band requirements can be installed, and integrated operationally, with existing repeaters using the Zetron Models 452/459 controllers. For the busier sites, found in ATTACHMENT 4 - Traffic Summary 2000, a second channel LTR can be added, enabling dual channel & dual mode conventional radios, and LTR radios to share site repeater facilities.

11 Recommendations

11.1 General - Paging

This Section recommends the rollout of the paging network with consideration to the fact that mobile upgrade/replacement will be implemented simultaneously.

The following recommendations are offered for consideration by NLH IS&T:

11.1.1 The infrastructure required to support the 47 existing pagers is not justified. Third party Province-wide PSTN dial-up paging systems should be utilized where coverage permits. Where third party coverage does not meet NLH operations, the current NLH pager user should be given a portable radio on the new Network.

11.2 General - Mobile

11.3 Mobile System Recommendations

11.3.1 A specification be prepared for tendering Request for Proposals. Generic function definitions of radio models, and associated price breakdown requested based on quantity range. **While this Report offers the best estimates at this stage, the Writer is aware of planning, and corporate affiliations which could cause a change in technology, and costs, overnight, which is consistent with the rapid growth, and aggressive competition in the trunked radio market.**

11.3.2 The Specification should provide for mandatory requirements, but also identify options which are not covered in immediate implementation. This will facilitate the decision making process for implementing the final network within approved budgets, and budgeting for what is necessary. Any options, not initially approved by IS&T, are therefore identified for future annual budgeting, with vendor cost commitments 'up front'.

11.3.3 The preferred frequency band for the 10 year study life is VHF.

11.3.4 The preferred mobile radio system is LTR.

11.3.5 Quantities of specific mobile radio models must be decided for NLH users, with attention paid to future applications/needs (i.e. data, Automatic Vehicle Location -AVL, using GPS), since costs are more sensitive to variations, compared with existing conventional mobile radio.

11.3.6 Continued shared use with W,S, & T, since growth should not change, except fo the addition of approximately 100 radios currently used for simplex operation only (as identified by WS&T in a Meeting with NLH dated 2001 02 15, and to be confirmed with a follow-up Letter to the Meeting) .

11.3.7 Industry Canada Policy for join use must be considered both for mobile and microwave joint use, since, depending who is jointly

using the network(s), mandatory, unlimited use may be enforced by Industry Canada - refer to Industry Canada's Policy letter - **Attachment 14 - Industry Canada's Policy Letter.**

Further discussion shall be completed with Industry Canada, in the event Newfoundland Power wishes to become a joint owner of the NLH mobile radio system. Newfoundland Power would be required to pool their VHF frequencies for implemetation of a shared mobile radio system upgrade. Consideration to phase in 12.5 kHz radios is required for future expansion, with consideration to required data throughput.

11.3.8 Since the radios are data pipes only, it will be necessary to identify NLH data requirements from a data infrastructure (IT) requirement. If a complete current mobile data assessment of needs/applications is not fully identified now, particularly for bandwidth requirements, a separate radio system may be required, or added later, since data rates are alternative dependent.

11.3.9 The requirement for status messaging is significant in the long term mobile system. These requirements should be obtained from radio users, and included in the Specification, and as add-on options in the long term implementation, as costs are dependent upon the user equipment model provisioned, and dispatch configuration.

11.3.10 Radio coverage prediction should be completed prior to preparation of the Specification, especially prior to preparation of costing, to add Newfoundland Power, since redundant sites have been determined in preliminary technical discussions with Newfoundland Power (i.e. Meeting 2001, February 23).

11.3.11 Radio coverage measurements shall be completed as part of final commissioning, and compared with predictions, for future reference of coverage variations.

11.3.12 An Implementation Plan, including supplementary coverage site work, for radio paging & mobile system be completed as the next step following a decision of IS&T to proceed. The schedule for the Final Implementation Plan be completed following acceptance of

the preferred mobile radio proposal.

12 Implementation

12.1 General

12.1.1 Supplement coverage areas with portables, for existing pager users.

12.1.2 Identify all supplementary sites required to complete total radio coverage needs, and provide for infrastructure work to be completed. This work must be scheduled to match installation times for adjacent backbone trunked radio installations. This is required to entertain the addition of Newfoundland Power as a joint owner, since many sites have been found redundant with NLH. Further discussions are required with Newfoundland Power.

12.1.3 Low bandwidth radio links to third party supplementary sites shall be required to fulfill coverage objectives. Licensing applications for fixed links shall be completed and submitted to improve authorization lead time.

12.1.4 Once approval is obtained from IS&T to proceed, an Implementation Schedule shall be completed for the tendering process, supplier delivery, and shall include prioritization of sites (coverage areas) to be installed. Newfoundland Power traffic requirements must be determined for the areas within their operational areas.

12.1.5 The process to prepare mobile specifications, tender, review proposals, award the tender, manufacture the equipment, and begin implementation will take an estimated 12 - 18 months.

12.1.6 Completion of site work, including third party tower analysis of third party & supplementary sites, and necessary reinforcement, should be completed first; budgets for tower upgrade can be allocated and this work can be completed while the mobile radio system is being manufactured. Site space & power upgrade can be installed in supplementary coverage sites, in readiness for the mobile radio installation and commissioning.

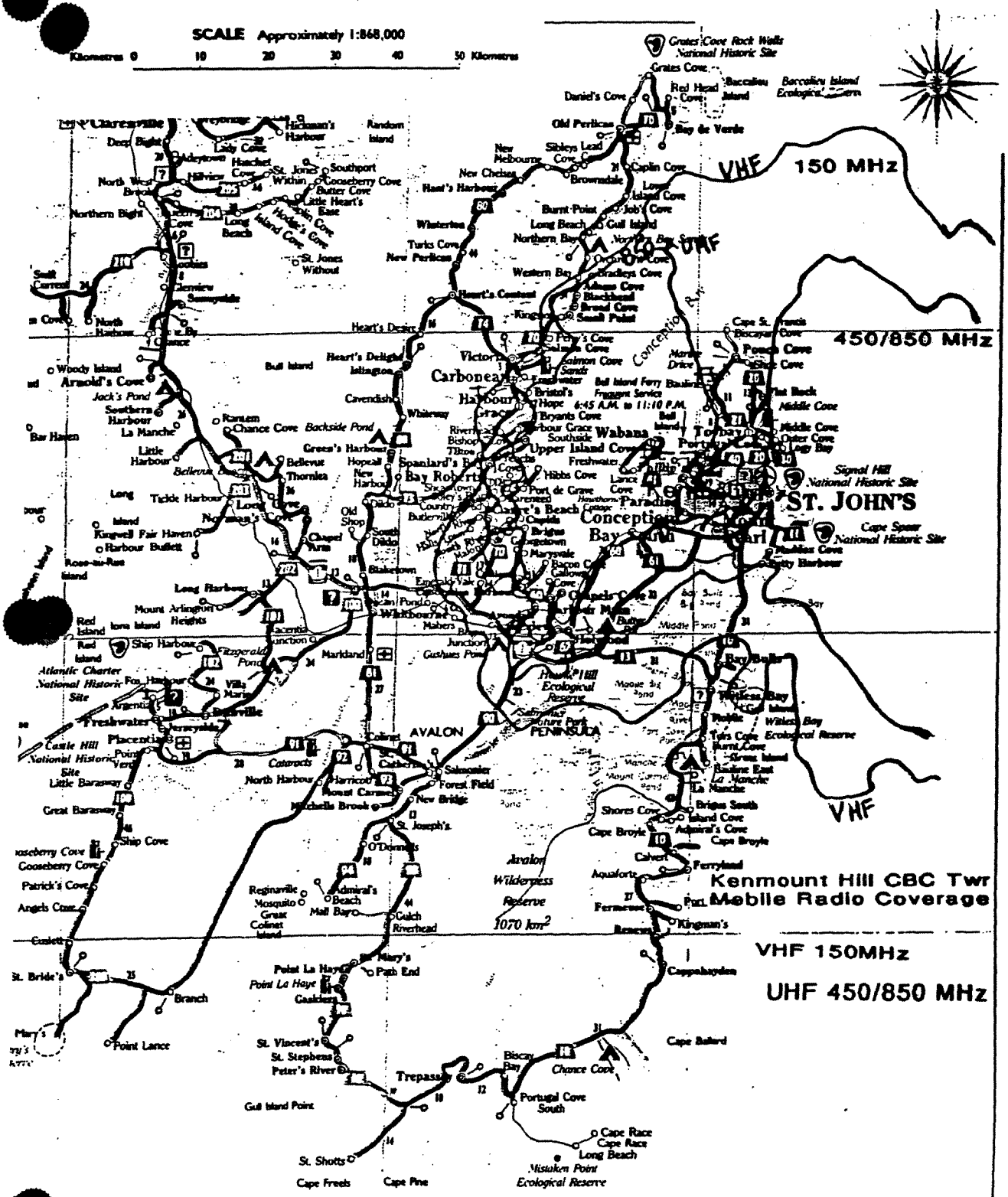
12.1.7 Microwave links should be equipped with the necessary mux cards, and associated end-to-end paging & mobile circuits commissioned.

12.1.8 A decision for the location of the trunking switch should be made, and building

readiness can be planned to merge with the overall schedule.

12.1.9 The overall Schedule can be finalized, with milestones and critical paths, when firm deliver dates are provided in the tender evaluation process.

ATTACHMENT #1



ATTACHMENT 2

Radio Distribution List

Area Offices	Pagers	Mobiles	Portables	Base Stations
St. John's - ECC	19	39	10	4
Bay D'Espoir	12	25	21	2
Bishop's Falls	2	90	15	5
Churchill Falls				
Happy Valley		17	4	4
Holyrood	2		3	2
Port Saunder's	5	21	8	3
St. Anthony	3	20	13	1
Stephenville	2	16	6	4
Wabush		6	2	2
Whitbourne	2	15	3	6
Totals	47	249	85	33

ATTACHMENT # 8

List of References

1. NLH (MDMRS) System Description, Issue 3A, Aug. 7, 1990.

2. EIA/TIA TSB88 -1, Wireless Communications Systems - Performance in Noise and Interference Limited Situations - Recommended Methods for Technology-Independent Modeling, Simulation, and Verification (including Addendum 1), December 1998.

3. User Group (Site Traffic) Comparison for NLH, Year 2000.

ATTACHMENT # 4

ATTACHMENT #
Sheet 1 of 3.

Newfoundland & Labrador Hydro - Mobile Traffic Summary, Year 2000
Peak Usage Shown

2000 Month	Site(s)	W.S. &T		N&LH		TOTAL	
		PEG	Usage,min.	PEG	Usage,min.	PEG	Usage,min.
Jan	Bay D'Espoir Hill	566	727	959	847	1525	1574
	Bonne Bay	2261	2271	114	105	2375	2376
	Clarenville	2701	2636	48	36	2749	2672
	Corner Bk.	2626	2309	30	29	2656	2338
	Mt. Margaret	2886	3497	322	360	3208	3857
	Red Cliff	2873	3744	524	506	3397	4250
	All Sites Totals	**28029**	**30795**	**4831**	**4590**	**32860**	**35385**
Feb	Bay D'Espoir Hill	232	301			232	301
	Bonne Bay	1813	1703	77	75	1890	1778
	Clarenville	2198	1924	20	17	2218	1941
	Corner Bk.	2370	2143	37	32	2407	2175
	Mt. Margaret	3013	3929	338	391	3351	4320
	Red Cliff	1366	1678	342	277	1708	1955
	St. Anthony	1662	1753	325	282	1987	2035
	All Sites Totals	**20357**	**21842**	**4353**	**3983**	**24710**	**25825**
Mar.	Bay D'Espoir Hill	310	411	1055	950	1365	1361
	Bonne Bay	1002	919	154	161	1156	1080
	Clarenville	2356	2127	26	26	2382	2153
	Corner Bk.	1330	1189	62	63	1392	1252
	Mt. Margaret	2192	2561	468	502	2660	3063
	Red Cliff	1719	2267	640	538	2359	2805
	St. Anthony	1437	1264	1222	1327	2659	2591
	All Sites Totals	**17226**	**18081**	**6996**	**6681**	**24222**	**24762**
April	Bay D'Espoir Hill	140	181	1062	1003	1202	1184
	Bonne Bay	385	374	393	416	778	790
	Clarenville	1088	995	37	25	1125	1020
	Corner Bk.	723	576	13	12	736	588
	Kenmount Hill	1062	816	260	181	1322	997
	Mt. Margaret	900	980	541	630	1441	1610
	Red Cliff	484	519	509	493	993	1012
	St. Anthony	400	327	356	374	756	701
	All Sites Totals	**7665**	**7372**	**5688**	**5497**	**13353**	**12869**
May	Bay D'Espoir Hill	74	89	836	641	910	730
	Bonne Bay	406	360	371	465	777	825
	Clarenville	887	735	51	28	938	763
	Corner Bk.	842	663	39	37	881	700
	Kenmount Hill	1084	873	122	65	1206	938
	Mt. Margaret	705	842	402	460	1107	1302
	Red Cliff	683	758	605	528	1288	1286
	St. Anthony	301	253	289	270	590	523
	All Sites Totals	**7041**	**6536**	**5160**	**4736**	**12201**	**11272**

ATTACHMENT # 4

2000

Month	Site(s)	W.S. &T		N&LH		TOTAL	
		PEG	Usage,min.	PEG	Usage,min.	PEG	Usage,min.
June	Bay D'Espoir Hill	44	49	937	770	981	819
	Bonne Bay	363	242	327	321	690	563
	Clarenville	809	610	129	98	938	708
	Corner Bk.	832	729	132	123	964	852
	Kenmount Hill	1333	1125	195	121	1528	1246
	Mt. Margaret	448	433	595	616	1043	1049
	Red Cliff	690	637	680	601	1370	1238
	St. Anthony	136	108	395	410	531	518
	All Sites Totals	6391	5453	6829	6224	13220	11677
July	Bay D'Espoir Hill	88	102	1596	1377	1684	1479
	Bonne Bay	237	171	229	227	466	398
	Clarenville	851	672	38	27	889	699
	Corner Bk.	605	451	73	78	678	529
	Kenmount Hill	959	841	105	67	1064	908
	Mt. Margaret	436	382	567	716	1003	1098
	Red Cliff	457	419	573	557	1030	976
	St. Anthony	216	180	377	373	593	553
	All Sites Totals	5083	4230	6840	6948	11923	11178
July	Bay D'Espoir Hill	88	102	1596	1377	1684	1479
	Bonne Bay	237	171	229	227	466	398
	Clarenville	851	672	38	27	889	699
	Corner Bk.	605	451	73	78	678	529
	Kenmount Hill	959	841	105	67	1064	908
	Mt. Margaret	436	382	567	718	1003	1100
	Red Cliff	457	419	573	557	1030	976
	St. Anthony	216	180	377	373	593	553
	All Sites Totals	5083	4230	6840	6948	11923	11178
Aug.	Bay D'Espoir Hill	78	99	1038	811	1116	910
	Bonne Bay	201	129	144	149	345	278
	Clarenville	937	766	30	22	967	788
	Corner Bk.	551	508	231	306	782	814
	Kenmount Hill	932	748	62	35	994	783
	Mt. Margaret	211	212	447	569	658	781
	Red Cliff	686	663	566	551	1252	1214
	St. Anthony	82	60	545	607	627	667
	All Sites Totals	5528	4694	6879	7035	12407	11729

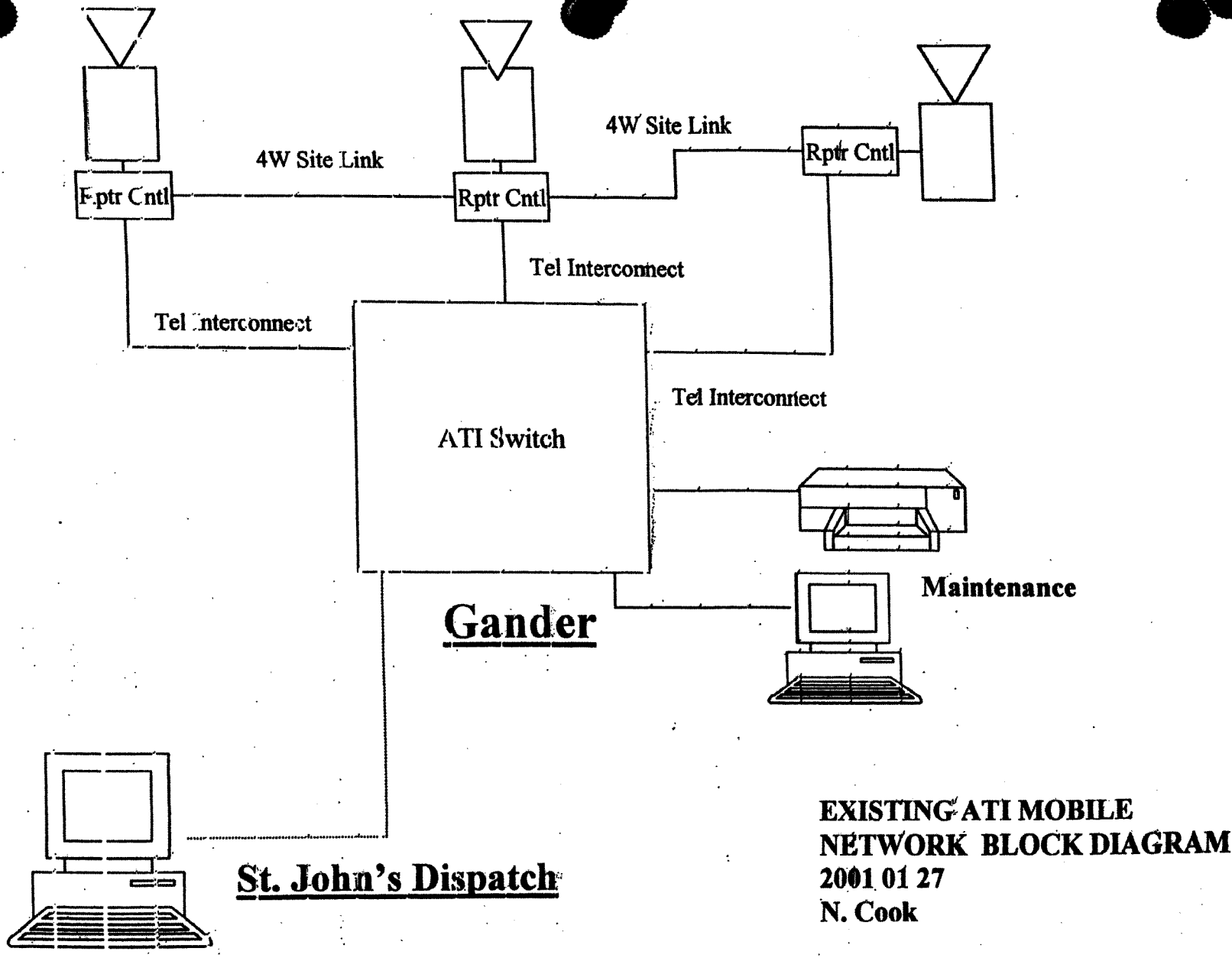
ATTACHMENT # 4

2000								
Month	Site(s)	W,S. &T			N&LH		TOTAL	
		PEG	Usage,min.		PEG	Usage,min.	PEG	Usage,min.
Sept.	Bay D'Espoir Hill	112	127		1151	991	1116	910
	Bonne Bay	150	103		202	197	345	278
	Clarenville	1143	950		61	44	967	788
	Corner Bk.	633	508		115	111	782	814
	Kenmount Hill	2976	2610		68	41	994	783
	Mt. Margaret	241	235		369	394	658	781
	Red Cliff	759	761		644	623	1252	1214
	St. Anthony	123	86		525	502	627	667
	All Sites Totals	**7547**	**6609**		**7083**	**6682**	**12407**	**11729**
Oct.	Bay D'Espoir Hill	96	139		1229	1219	1263	1118
	Bonne Bay	264	174		281	280	352	300
	Clarenville	784	668		70	42	1204	994
	Corner Bk.	806	634		78	84	748	619
	Kenmount Hill	902	759		52	34	3044	2651
	Mt. Margaret	482	572		589	653	610	629
	Red Cliff	822	819		485	452	1403	1384
	St. Anthony	207	142		421	425	648	588
	All Sites Totals	**6245**	**5691**		**6823**	**6804**	**14630**	**13291**
Nov.	Bay D'Espoir Hill	175	206		1042	907	1325	1358
	Bonne Bay	557	418		316	293	545	454
	Clarenville	1368	1087		29	17	854	710
	Corner Bk.	1449	1175		215	223	884	718
	Kenmount Hill	860	655		99	57	954	793
	Mt. Margaret	321	288		521	564	1071	1225
	Red Cliff	896	941		577	552	1307	1271
	St. Anthony	260	224		398	376	628	567
	All Sites Totals	**9313**	**8230**		**6344**	**5951**	**13068**	**12495**
Dec.	Bay D'Espoir Hill	166	214		264	242	1217	1113
	Bonne Bay	1025	905		24	25	873	711
	Clarenville	1403	1352		19	20	1397	1104
	Corner Bk.	1322	1257		21	15	1664	1398
	Kenmount Hill	188	128		31	20	959	712
	Mt. Margaret	1024	1328		196	205	842	852
	Red Cliff	1150	1517		137	155	1473	1493
	St. Anthony	607	598		108	105	658	600
	All Sites Totals	**11296**	**12264**		**1747**	**1688**	**15657**	**14181**

	A	B	C	D	F	G	H	I	J	K
1	CUSTOM								File:\NLH\MobSys.Estim	
2	SYSTEMS			Newfoundland & Labrador Hydro						
3	ELECTRONICS LIMITED			Mobile System Alternatives Estimates					Sheet 1 of 2.	
4										
5				Transcrypt		Motorola		CNEricsson	NOTES	
6	**Mobile System:**	Qty	TETRA	LTR		SmartZone		EDACS	Rev 01 03 05 -00	
7	**General:**									
8	Architecture >>>>>>		Open	Open		Proprietary		Proprietary		
9	Frequency Band, MHZ		450	150/450/850		150/450/850		150/450/850		
10	Mode		Digital	Analogue		Analogue		Digital		
11	**Description:**									
12	**Redundant Central Switch**	1	$550,000	$500,000		$1,400,000		$3,600,000		
13	**Site Equipment (Rptr/Contl,Ant**	35	2,625,000	2,100,000		2,625,000		3,150,000	Single Ch Site.	
14	- add mobile data capacity 1 rptr/site	35	1,750,000	875,000		1,750,000		1,750,000	LTR use Zetron 42/459	
15	**Mobile Radios - avg. model**	50	202,500	112,500		262,500		212,500		
16	-80% w.data,reference Attach # 2	200	810,000	450,000		2,050,000		1,050,000		
17	add GPS AVL to data	200	200,000	200,000		200,000		200,000		
18	**Portable Radios -avg. model**	85	272,000	85,000		425,000		340,000	Transcrypt User	
19	-reference Attachment 2								Equipt. is Less Cost.	
20	**Base Stations- mob w. PSupp.**	33	231,000	156,750		247,500		231,000		
21	**Sub Total**		**6,640,500**	**4,479,250**		**8,960,000**		**10,533,500**		
22	**Features - incremental $ shown:**									
23	- Encryption (per mob/port/base)		600							
24	- Data		UE incl'd	UE incl'd		1200 incl'd		UE incl'd	UE= User Equipment	
25	Nominal Rate		28.8kbps	1.2/2.4kbps		1.2kbps		9.6kbps	Data Infrastructure	
26	Throughput Rate		19kbps					7.2kbps	needs OS,Andi's Soft.	
27	- Mobile Network CPU/Router	1	150,000	150,000		150,000		250,000	EDACS = 8 Ports	
28	- Status Messaging									
29	- GPS AVL (per mobile)		1,000	1,000						
30	**Miscellaneous:**									
31	- Add Tower Contingency(3)		450,000	450,000		450,000		450,000		
32	- Extended Cover Link Facilities		400,000	400,000		400,000		400,000		
33	- Engineering Ext.		60,000	60,000		60,000		60,000		
34	- Drafting/Documentation		25,000	25,000		25,000		25,000		
35	- Commissioning/Fact. Test		75,000	75,000		75,000		75,000		
36	- Radio Coverage Equipment		25,000	25,000		25,000		25,000		
37	- Demolition		105,000	105,000		105,000		105,000		
38	- Training		100,000	100,000		100,000		100,000		
39	**TOTAL less HST**		**$7,880,500**	**$5,719,250**		**$10,200,000**		**$11,773,500**		

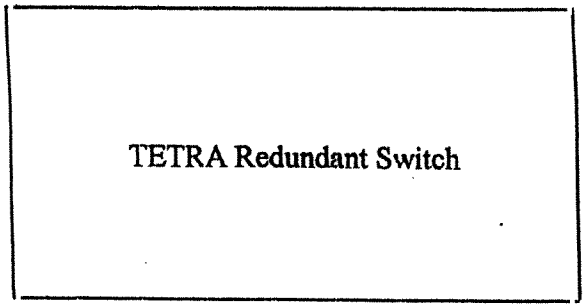
ATTACHMENT 5

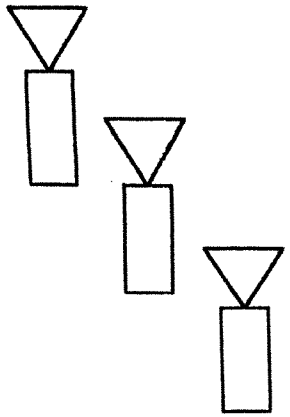
	A	B	C	D	F	G	H	I	J	K
41									Sheet 2 of 2.	
42	CUSTOM			Newfoundland & Labrador Hydro						
43	SYSTEMS			Mobile System Alternatives Estimates						
44	ELECTRONICS LIMITED								Rev 01 03 05 -00	
45										
46										
47	**Paging System:**		Typical			**Independent Mobile Data System:**				
48						(req'd for SmartZone for usable data throughput.)				
49	Encoder - Redundant	2	60,000			Data Controlr:	1	150,000		
50	- dual Analogue/Digital									
51						Appl. Server:	1	150,000		
52	Site Equipment:		see Options below							
53						Base Stas	35	1,750,000		
54	**Option 1**									
55	- Analogue Txs	35	1,575,000			Engineering		250,000	or use existing	
56	- Off Air Confirm at Site	35	105,000						paging Txs	
57	- Paging Receivers	50	22,500			Installation		110,000		
58	(Dual T&V + Alphanumeric)									
59	**Sub T. Opt1**		**1,762,500**			**Sub Total Data**		**2,410,000**		
60	**Option 2**									
61	- Digital Txs	35	2,100,000			**GPS Rx**	1	1,500		
62	- Off Air Confirm at Site	35	105,000							
63	- Paging Receivers	50	7,500			**ADD: Software Development Costs**				
64	(Digital)					**or Applications Service Provider Costs**				
65	**Sub T. Opt2**		**2,272,500**							
66										
67	**Preferred Option LTR - COST SUMMARY:**									
68		Cell R	Description							
69		E22	Basic System		$4,479,250					
70		I59	Data Router		660,000					
71		E32-3	Miscellaneous		1,240,000					
72		C49	Paging Encoder		60,000					
73		C57	Pagers		22,500					
74		C62	Off Air Page Conf		105,000					
75										
76			**TOTAL SYSTEM**		**$6,566,750**					
77										



EXISTING ATI MOBILE NETWORK BLOCK DIAGRAM
2001 01 27
N. Cook

ATTACHMENT # 6



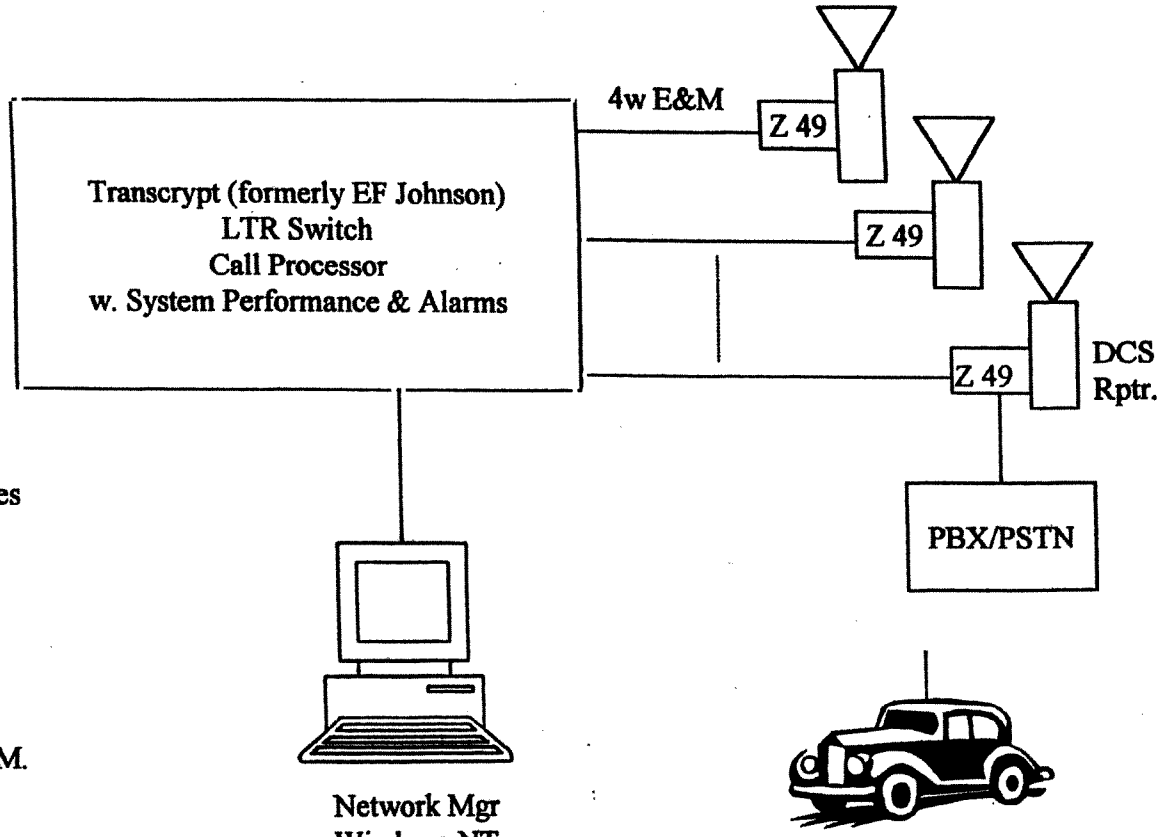


TETRA Features
-TDMA
-Mobile Data 28.8kbps (19.2kbps throughput))
-Redundant w. triple mission critical processors
-Inique Open Standard MOU–ETSI 1995
-Many Radio Manufacturers
-Few Systems in North America
-Central or Distributed Processing
-450 MHz Band (Europe)

TETRA
Block Diagram NLH IST
2001 01 24
N. Cook

TO BE COMPLETED

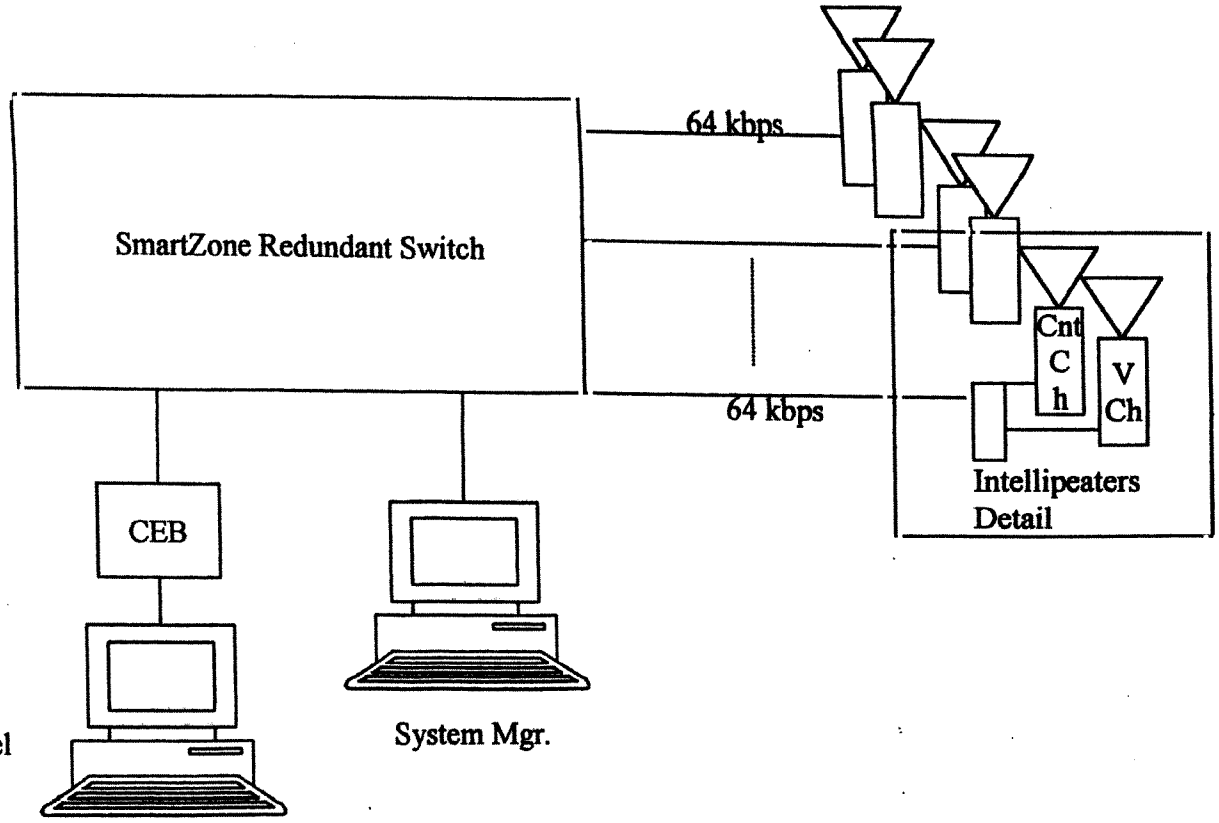
ATTACHMENT 7



Logic Ttrunked Radio LTR Features
-Analogue
-FDMA
-Mobile Data 1.4 kbps/2.4 kbps
-Redundant ???
-Open Standard E.F Johnson
-Local Service
-Zetron 49 Site Cntt I/F Tel,4wE&M.
- & Site Stats.
-Inexpensive Radios
-Many Radio Manufacturers
-Radios 12.5/25 MHz BW Program
-Central or Distributed Processing
-150/450/850 MHz Band
-Subscriber Manager Activity Logger

LTR Mobile Radio
Block Diagram NLH IS&T
2001 01 24
N. Cook

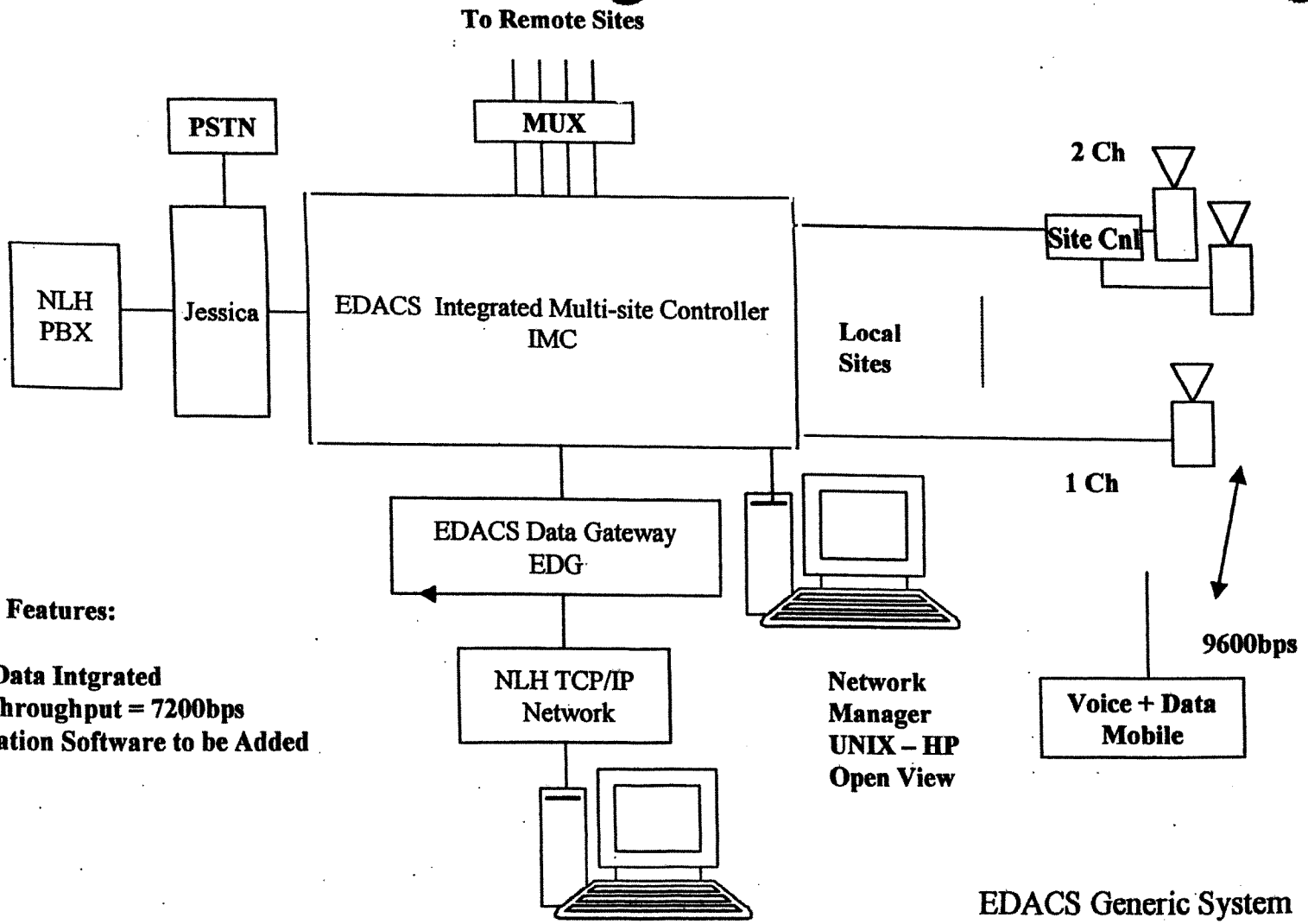
ATTACHMENT 8



SmartZone Features
-FDMA
- Msoft NT Network Protocol
-Mobile Data 2kbpson Cntl Channel
-Dedicated Control Channel
-Minimum 2 Chs per Site
-Proprietary Network
-Many Systems in North America
-Central Processing, fault tolerant
-150/450/850 MHz Band

SmartZone Network
Block Diagram NLH IST
2001 01 24
N. Cook

ATTACHMENT # 9

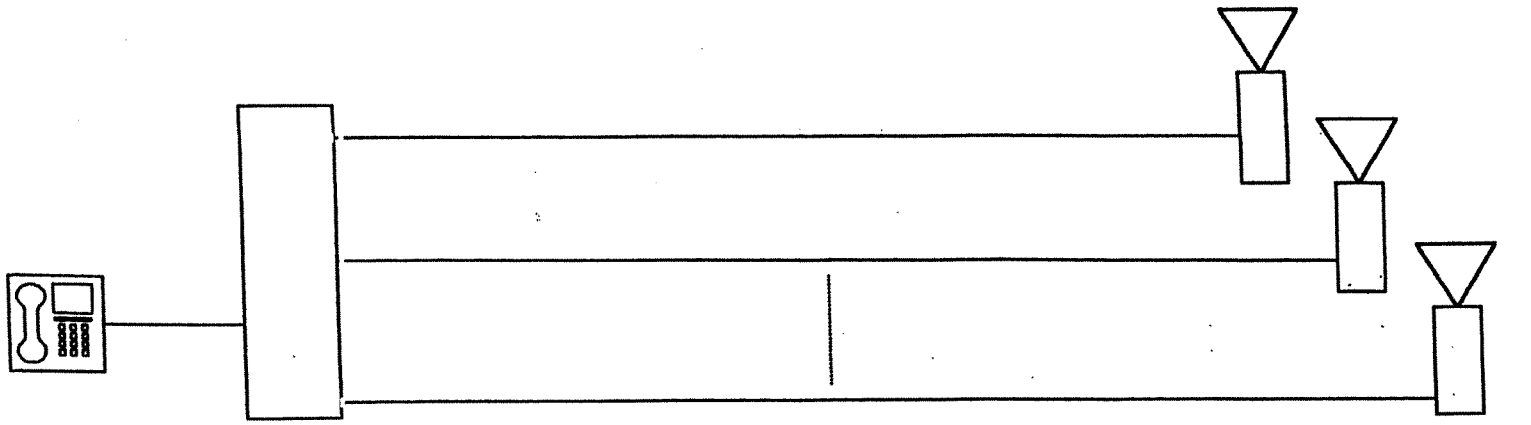


EDACS Features:

-Voice/Data Intgrated
-Data Throughput = 7200bps
-Application Software to be Added

EDACS Generic System
Block Diagram NLH IST
2001 01 24
N. Cook

ATTACHMENT # 10



Paging Features:

-Tone &Voice (NLH)
- Limited voice storage.
- Redundant/separate to Mobile System

-Disadvantage – no confirmation
-Many Radio Manufacturers

-Existing is VHF (max coverage)
-Pagers are expensive

DIGITAL OPTION

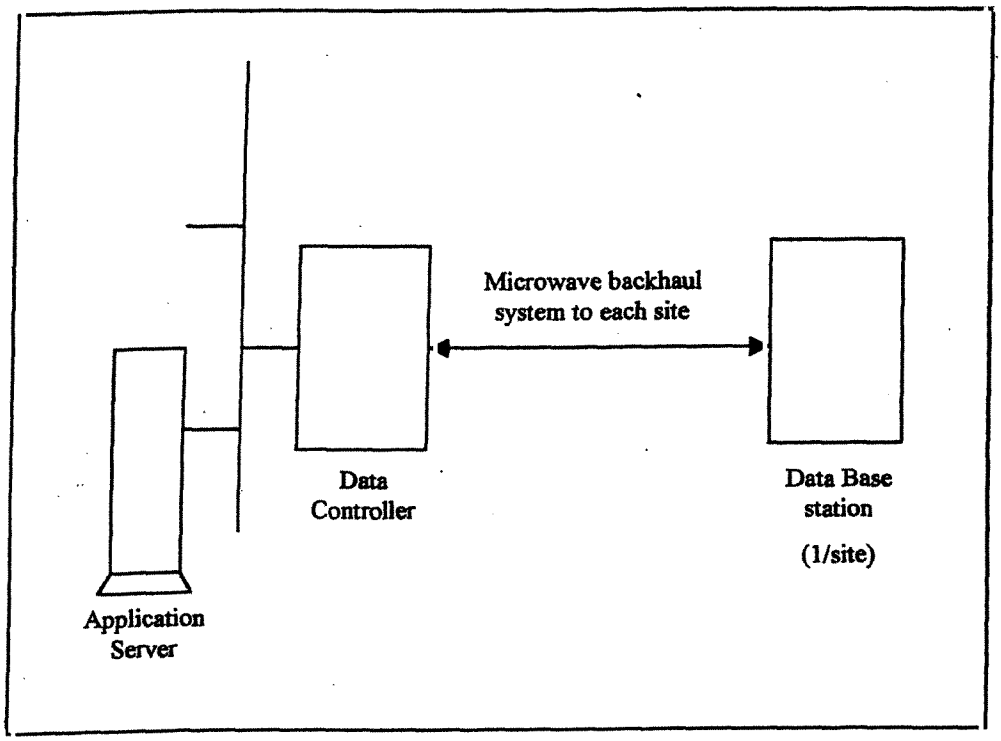
POCSAG (Alpha Numeric)
- Many message storage capability
- Pagers store many messages
- Time/Date Stamp
- Disadvantage – no confirmation
- Displays difficult to read exc. zoom
- Many Radio Manufacturers.
- Digital Ready Transmitters Req'd.
- Pagers 1/3 cost of T&V

Paging Network

Block Diagram NLH IST
2001 01 24
N. Cook

ATTACHMENT # 11

ATTACHMENT # 12



Dedicated Data System Block Diagram

ATTACHMENT # 13

[redacted]Lab Hydro Existing Repeater Sites

Site Name	Latitude (N)	Longitude (W)	Elevation (m AMSL)	Owner	Tower Ht. (m)	ERP (W)	TX Freq	RX Freq	Notes
Annieopsquotch	48 15 05	57 43 26	558	RCMP?	50	12	162.63	170.19	Twr. ht. Incorrect?
Bay d'Espoir Hill	47 59 42	55 46 5	262	NLH	54	77.6	164.22	170.28	
Bay l'Argent	47 32 11	54 51 34	244	NTM	40	102	162.63	170.19	
Blue Grass Hill	49 03 31	57 11 13	434	NLH	48	95.5	163.08	172.29	
Blue Mountain	51 29 31	55 45 58	unknown	NLH	15	126	164.79	170.52	
Bonne Bay	49 22 10	57 44 16	480	NTM	40	105	163.86	170.22	Three Tom
Brent's Cove	49 54 37	55 40 23	198	NTM	50	102	164.22	170.28	
Carmanville	49 25 13	54 17 27	89	NTM	45	105	163.23	170.49	
Clarenville	48 11 21	54 02 17	290	NTM	88	93.3	162.75	170.34	Shoal Hr.
Codroy	48 03 31	58 51 27	389	NTM	31	110	163.08	172.29	
Corner Brook	48 55 11	57 58 15	381	NTM	71	60.3	172.53	167.43	
Gambo	48 49 49	54 22 04	207	NTM	43	102	163.08	172.29	
Godaleich Hill	48 15 28	56 10 00	350	NLH	48	15	163.23	170.49	
Hawke Hills	47 19 19	53 07 32	290	NTM	29	102	163.08	172.29	Four Mile
Hermitage	47 33 32	55 56 21	274	NTM	25	112	163.86	170.22	
Jackson's Arm	49 52 57	56 47 06	290	NTM	13	117	163.62	170.01	
Kenmount	47 32 01	52 47 27	255	NTM	20	74.1	172.53	167.43	Ht. Approx
Millertown	48 48 36	56 31 45	232	NTM	96	87.1	163.86	170.22	
Mount Margaret	51 01 05	56 48 47	279	NTM	60	105	162.75	170.34	
[redacted]Saunders	50 38 58	57 17 51	79	NTM	124	102	162.63	170.19	
[redacted]nd Creek	50 08 41	57 37 39	172	NTM	20	115	164.79	170.52	
Red Cliff	48 57 13	55 47 43	199	NTM	137	70.8	164.79	170.52	
Red Rocks	47 40 35	59 18 10	197	NTM	71	95.5	163.62	170.01	
Rocky Ridge	47 51 20	57 39 08	488	NTM	21	29.5	163.62	170.01	
Serrated Hills	47 40 26	53 51 48	213	NTM	46	10	163.62	170.01	
Sheffield	49 21 42	56 33 24	468	NTM	94	89.1	162.75	170.34	
Southwest Brook	51 01 14	56 08 47	92	NTM	65	95.5	163.62	170.01	
St. Anthony	51 20 56	55 36 36	132	NTM	46	112	163.86	170.22	
Stephenville	48 31 38	58 29 13	130	NTM	36	105	164.79	170.52	

Lab Hydro Owned Potential New Repeater Sites

Site Name	Latitude (N)	Longitude (W)	Elevation (m AMSL)	Tower Ht. (m)	Year Avail.	Potential Site Replacing	Notes
Gull Pond Hill	48 17 29	55 28 31	285	82	Immed	None	
Sandy Brook Hill	48 52 36	55 47 24	283	93	Immed	Red Rocks	
Mary March	48 49 12	56 43 15	335	115	Immed	Millertown	
Deer Lake	49 10 38	57 24 21	59.5	20	Immed	Bonne Bay	
Petty Harbour	47 30 53	52 44 22	160	40	2002	Kenmount	
Four Mile	47 19 42	53 07 30	290	82	2002	Hawke Hill	
Chapel Arm	47 30 38	53 43 22	224	82	2002	Serrated Hill	
Bull Arm	47 49 45	53 56 19	145	90	2002	Clarenville/Serrated	
Granite Canal	48 11 51	56 49 18	332	30	2003	Annieopsquotch	Tower ht. TBD
Burnt Dam	48 9 46	57 20 20	321	30	2003	Annieopsquotch	Tower ht. TBD
Grandy Brook	47 46 59	57 39 32	318	TBD	2002	Rocky Ridge	New Site
Shoal Harbour	48 11 21	54 2 17	263	40	2003	Clarenville	Tower ht. TBD
Glovertown	48 40 34	54 4 40	191	40	2003		Tower ht. TBD
Johnathan's Pond	49 3 53	54 30 21	126	40	2003		Tower ht. TBD
Southwest Brook	49 10 43	55 2 42	73	60	2003		Tower ht. TBD

ATTACHMENT # 14

Industry Canada's Joint Use Policy Summary Letter

ATTACHMENT #14

[redacted]m Cook, P.Eng.

From: <Guerrette.Rene@ic.gc.ca>
To: <CSEL@CSEL.nf.ca>
Sent: Tuesday, February 06, 2001 1:53 PM
Subject: FW: Microwave Licensing Policies

Norm,,
Hope this helps

René

> ----Original Message----
> From: Guerrette, Rene: STJ
> Sent: Monday, February 05, 2001 12:36 PM
> To: Cook Norman (E-mail)
> Cc: Richard, Roland: MCN; Leblanc, Mike: MCN
> Subject: Microwave Licensing Policies
>
>
> Norm,
>
[redacted] per our discussions, I looked a little further into the policies involved in Nfld.. Hydro changing it's status from a microwave user to a
> microwave carrier. We also discussed the possibility of NFLD Hydro
> becoming a full fledged service provider. The policies with regards to
> becoming a service provider on the mobile side of the operations are
> separate and even less restrictive. We can discuss this aspect of the
> requirements if and when you are ready. For the purpose of furthering your
> inquiry into the possibilities offered under the microwave, please refer
> to the following policies; RP 015, RP 017, RP 018, RP 022. Radio
> communications Act(RA), Telecommunications Act(TA) and the Broadcasting
> Act(BA). I mention the BA only since the RP 022 asks for comments on
> combining the 3 policies into the one in an attempt to further liberalize
> the policy on microwave licensing.
>
> The other 2 acts, TA and RA provide the requirements from an ownership
> control perspective for Canadian companies wishing to operate as common
> carriers. As a CC, companies fall under the regulatory aspect of the CRTC.
> A visit to their web site may provide more info on the implications of
> being regulated under the TA. As well, there may be provincial PUB issues
> that could affect the carriers of telecommunications.
>
> Feel free to call me if you have any further questions.
>
[redacted]gards,

> René
>