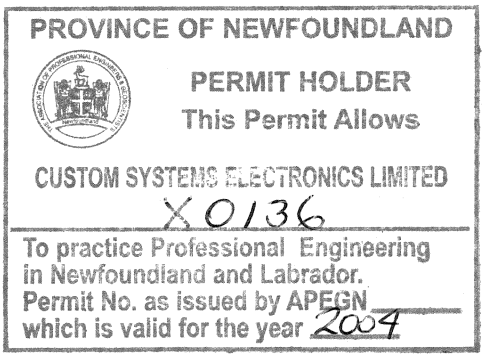
Newfoundland & Labrador Hydro

Mobile Radio System Replacement
Summary of Findings

August 2004



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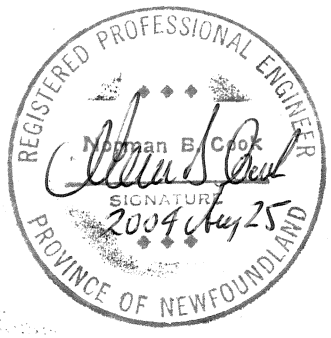

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Acronym List

CPW - Cumulative Present Worth

CRTC - Canadian Radio-television Commission

CSEL - Custom Systems Electronics Limited

DTW - Provincial Department of Transportation and Works

IC-SM - Industry Canada - Spectrum Management

MRS - Mobile Radio System

NLH - Newfoundland & Labrador Hydro

NP - Newfoundland Power

NPV - Net Present Value

RFI - Request for Information

VHF - Very High Frequency

Executive Summary – Conclusions and Recommendations

The Public Utilities Board in its Order No. P.U. 29 (2003) (the "Order") required that a cooperative process be undertaken to further review both Newfoundland Power Incorporated's (NP) and Newfoundland and Labrador Hydro's (NLH) Mobile Radio System (MRS) requirements. This has been completed as outlined in this Report.

Currently, NLH requires the replacement of its existing MRS, and the Provincial Department of Transportation and Works (DTW) is seeking financial approval to continue sharing the NLH MRS.

NP does not require its MRS to be replaced/upgraded until 2011; however, the option of NP participating in the proposed NLH replacement MRS at 2 years, 3 years and 5 years after the initial in-service date has been reviewed as well as the option of accommodating NLH on an expanded NP MRS.

This Report discusses the details of the various alternatives that were considered and the resulting economic comparisons are presented.

The alternatives considered in this report are as follows:

- Alternative 1 is the extension of the existing NLH MRS to allow for implementation of a common system at a future date or any other reasonable alternative that will allow replacement of both systems. As described in Section 4 of this report, the extension or expansion of NLH's existing system is not technically possible or viable;

- Alternative 2 is NLH alone on the proposed NLH replacement MRS.

- Alternative 3 is accommodating NLH on an expanded NP system (without DTW);

- Alternatives 4 is the replacement of the existing NLH MRS to meet NLH and DTW requirements; and

- Alternatives 5,6, & 7 are the replacement of the existing NLH system to meet NLH and DTW requirements and with NP participation in 2008, 2009 and 2011 respectively.

The Cumulative Present Worth (CPW) calculations are summarized in the following Table. Note that this does not include the capital required for NLH user equipment (i.e. mobiles and portables).

Table 4 - Results of NLH NPV Analysis (refer to Summary Sheets of Appendix C)

Alternative	Cumulative Present Worth ($M)
1. Expand NLH Existing System	Not Technically Possible
2. NLH alone on NLH replacement MRS	$14.895
3. Accommodating NLH on expanded NP MRS	$9.660
4. NLH and DTW on NLH replacement MRS	$7.448
5. NP joins NLH and DTW on NLH replacement MRS in 2008.	$6.858
6. NP joins NLH and DTW on NLH replacement MRS in 2009.	$6.942
7. NP joins NLH and DTW on NLH replacement MRS in 2011.	$7.090

Conclusions:

1. A mobile radio system is the only technology currently available that meets the requirements of NLH operations.

2. The most economic solution is for NLH to replace its existing MRS and to continue to accommodate DTW, and to provide for accommodation of NP at some future date.

3. NLH and NP have very different business requirements for their mobile radio systems which require different technical solutions. Accommodating NLH on NP's expanded system does not meet NLH's technical requirements; hence, alternative 3 is not an acceptable option for NLH. However, this option has been costed for purposes of this report.

4. The second best alternative for NLH is to replace the existing MRS as proposed and continue sharing with DTW, without accommodating NP.

5. Alternatives 5, 6 & 7 evaluates the cumulative present worth to NLH by NP joining the NLH system at 2 years, 3 years and 5 years after the initial in-service date. It should be noted that NP joining the NLH MRS is the only option which will provide a system which will provide field interoperability between the utilities. The proposed NLH MRS will provide a system having proven ease of configuration to allow for this flexibility.

1. Introduction

The purpose of this Summary Report is to describe the activities undertaken by NLH and NP to comply with the Order, with respect to the analysis of the feasibility of a single MRS that will meet the requirements of both utilities.

1.1 Terms of Reference – Order No. P. U. 29 (2003)

The sections of the Order with which this document is concerned are as follows:

1. **Newfoundland Power shall submit to Hydro a technical requirements document, including a detailed engineering assessment of the functional requirements needed by Newfoundland Power for operating a mobile VHF system into the foreseeable future.**
2. **Hydro shall generate a detailed working specification of the new VHF system that Hydro has selected and deliver a technical specification document, together with detailed capital costs to Newfoundland Power.**
3. **Newfoundland Power shall confirm, in writing to the Board, and to Hydro, whether the VHF replacement will meet Newfoundland Power's future operational requirements for a VHF radio system, together with a net present value calculation comparing the remaining life expectancy of Newfoundland Power's existing VHF system against adopting the new VHF system at 2, 3, and 5 years out and including confirmation of Newfoundland Power's participation in the new system once its existing system has reached the end of its useful life. As part of this exercise a determination and analysis must be carried out on the cost benefits to Newfoundland Power and to Hydro of (i) extending Hydro's VHF system to allow for implementation of a common system at a future date or any other reasonable alternative that will allow the replacement of both systems and (ii) accommodating Hydro on Newfoundland Power's existing VHF system.**
4. **In the event Newfoundland Power provides notice that it cannot, or will not, participate in a common VHF system the Board may order a hearing to investigate the matter.**
5. **In the event that Newfoundland Power provides notice that there is no technical or other impediment to its using a system in common with Hydro, both utilities shall provide confirmation of the basis on which they would share in the capital and operating costs of the new VHF mobile radio system.**
6. **Sharing agreements with Works, Services, and Transportation Department and others shall be firmed up to the extent possible to allow the Board to render a final decision on this project with all the available information.**

The Board may direct the utilities as to the substance of or timing of this process and may appoint a consultant to assist and advise throughout the process.

Significant activity has taken place since the Order was issued on September 5, 2003 to comply with the directives outlined above. Both parties have engaged consultants with experience in the

analysis and design of mobile radio systems. The consultants, in consultation with each other and with the engineering staff of both utilities, have developed requirements documents, technical specifications and financial analysis of the various options available. The results of this activity are summarized in Section 4 of this document.

2. Methodology/Chronology

The Order describing activities required by NLH and NP was issued on September 5, 2003. Contact was initiated with Newfoundland Power soon after and a preliminary meeting held with representatives of both organizations on October 18, 2003.

NLH retained the services of Custom Systems Electronics Limited (CSEL) to assist in the process. Mr. Norman Cook of CSEL (the "author") is a consultant with extensive experience in mobile radio and had already prepared a report for NLH in 2001 on the replacement of its mobile radio system, which had been previously submitted to the Board. NP retained the services of Provincial Consultants Limited to assist them in the process. Consultants from both parties communicated directly or brought representatives from the respective organizations into discussions as appropriate.

During the entire process, NLH and NP kept each other informed of status and information requirements through telephone calls, email, and face-to-face meetings. Representatives from both utilities met periodically to review progress, confirm technical or other details, and share information.

To meet the requirements of the Order, CSEL undertook the following activities:

.1 Reviewed previous NLH MRS Report (Mobile Radio Study, 2000 February), and Public Utilities Board hearing testimony, with consideration of new issues;

.2 Initiated a Terms of References of the utilities' MRS sharing arrangements, and reviewed Industry Canada – Spectrum Management (IC-SM) and Canadian Radio-television Commission (CRTC) policies on the telecommunications system sharing of Government related and private agencies. The latter issue was critical as to whether the sharing concept was feasible from a regulatory aspect;

.3 Performed a detailed review of both utilities' repeater site coverage to determine which radio sites were redundant in the event of a joint MRS. Any redundant sites/repeaters would be dropped from the list required for a joint system;

.4 Performed a user survey of NLH radio users, engineers, and planners, identifying which areas require additional coverage and establishing a list of MRS operational features;

.5 Developed a Technical Specification for a MRS, including the requirements identified by NP;

.6 Prepared a Request for Information (RFI) for distribution to recognized mobile radio system suppliers. Suppliers were asked to provide a technology solution for replacement of both utilities' MRS and to include budgetary costs for the system proposed in this Summary Report;

.7 Evaluated the responses to the RFI for feasibility and completeness and use the information to generate capital and operating costs estimates; and

.8 Completed economic analysis to assist in making a decision on the most feasible solution that meets the needs of both utilities.

Responses to the RFI were obtained in May 2004; however, due to the technical nature of the RFI, there were items that required clarification from vendors, resulting in detailed capital and operating cost estimates not being completed until July 2004.

3. Summary of Activities Related to Order No. P.U. 29 (2003), Conclusions and Recommendations

The activities undertaken specifically in order to comply with the requirements of the Order are described in this Section. Appendices contain the supporting documentation, including the MRS RFI Specification and the NPV Analysis.

1. **Newfoundland Power shall submit to Hydro a technical requirements document, including a detailed engineering assessment of the functional requirements needed by Newfoundland Power for operating a mobile VHF system into the foreseeable future.**

   NP's technical requirements were presented to NLH in February 2004 in a report that was prepared by Provincial Consultants Limited on behalf of NP. This report was used by NLH as an attachment in the subsequent MRS Request for Information (RFI) Technical Specification (see Appendix A, Attachment 2b) used to obtain technical alternatives and current costs of MRS alternatives for NLH MRS replacement.

2. **Hydro shall generate a detailed working specification of the new VHF system that Hydro has selected and deliver a technical specification document, together with detailed capital costs to Newfoundland Power.**

   In order to develop a detailed working specification, CSEL first reviewed the functional specifications of the existing system. Personal interviews and user survey results were then used to determine any new functional or radio coverage requirements. Finally, requirements were verified through a user focus group conducted with operations personnel after compilation and analysis of the survey and interview results. The final requirements were used to develop the specification, which was completed in April 2004 and forwarded to NP that time.

   To determine the required number of sites under the two scenarios, that is with or without the participation of NP, both consultants met with representatives of the two utilities to review site by site which sites were 'coverage redundant' and hence could be eliminated from the current configurations of the respective organizations. This final site list was agreed to by both parties as representing a best estimate at this point. It is noted that each utility selected the same number of sites, not necessarily the same sites, which were most suitable to achieve equivalent coverage in the event a joint system emerged from the respective utilities' feasibility studies.

   To assist in completing a detailed capital cost estimate, an RFI including the technical specifications to meet the MRS needs of both utilities was developed and sent to selected vendors. Four responses were received from four separate vendors. The capital cost estimate was developed from the responses received. This estimate was forwarded to NP on July 9, 2004. The MRS RFI document is contained in Appendix A.

In order to complete the economic analysis, however, additional information was required to generate an estimate for the operating costs associated with the system that were as detailed as possible. This exercise was complicated by the fact that a specific technology has not been chosen for this system, and operating costs will vary depending on the technology, system design, vendor, and availability requirements of the system. Furthermore, the amount and proportion of costs will change depending on the participation of DTW and NP. Estimates based on a "typical" configuration were prepared and sent to NP on July 16, 2004. Direct capital costs were provided to NP, since NP's economic model would include appropriate internal overhead factors.

3. **Newfoundland Power shall confirm, in writing to the Board, and to Hydro, whether the VHF replacement will meet Newfoundland Power's future operational requirements for a VHF radio system, together with a net present value calculation comparing the remaining life expectancy of Newfoundland Power's existing VHF system against adopting the new VHF system at 2, 3, and 5 years out and including confirmation of Newfoundland Power's participation in the new system once its existing system has reached the end of its useful life. As part of this exercise a determination and analysis must be carried out on the cost benefits to Newfoundland Power and to Hydro of (i) extending Hydro's VHF system to allow for implementation of a common system at a future date or any other reasonable alternative that will allow the replacement of both systems and (ii) accommodating Hydro on Newfoundland Power's existing VHF system.**

4. **In the event Newfoundland Power provides notice that it cannot, or will not, participate in a common VHF system the Board may order a hearing to investigate the matter.**

   NP has confirmed that the proposed NLH MRS would meet its operational requirements. It is understood that NP uses their current MRS for backup communications in the field, with primary mobile communications being provided through the use of cellular telephones.

   NP has advised that its most economical choice is for NP to retain its present system. A separate report will be filed by NP outlining the analysis it undertook to comply with the Order.

   NP has provided an estimated capital cost for the extension of its existing system to accommodate NLH. The NP MRS is not capable of providing the functionality to meet NLH's technical requirements, however, this option has been included in the analysis. Further discussion on this alternative is contained in Section 4.2 of this document.

5. **In the event that Newfoundland Power provides notice that there is no technical or other impediment to its using a system in common with Hydro, both utilities shall provide confirmation of the basis on which they would share in the capital and operating costs of the new VHF mobile radio system.**

Preliminary discussions have been held regarding the sharing of a common MRS, as it impacts the relative proportion of capital and operating costs assumed by each party, and therefore the economic analysis. It is proposed that each party will assume a share of the capital and operating costs in proportion to the number of sites it uses in the final configuration of the system.

6. **Sharing agreements with Works, Services, and Transportation Department and others shall be firmed up to the extent possible to allow the Board to render a final decision on this project with all the available information.**

   At the date of this report, the capital and operating details of participation of DTW cannot be confirmed. Discussions have been held with DTW officials and projected capital and operating costs have been supplied. DTW officials have prepared a briefing seeking Government approval for the funding required to purchase and operate this system. A reply is expected this Fall.

4. Alternatives for NLH MRS Expansion

4.1 Terms of Reference for Selection of a Replacement NLH MRS

A mobile radio system is a necessity for NLH to conduct its day-to-day operations for a variety of reasons. Mobile radio provides reliable user equipment, which is robust and suitable for all weather conditions, salt environment, and mechanical durability, making cellular or satellite telephony unsuitable, as the latter units are only available in models for general consumer use. Utilities also depend on mobile radio because of the lack of coverage of commercial services, the need for high availability communications during emergencies and in the performance of work that requires close coordination.

The primary technical objective of a MRS is to provide radio coverage over as much of the operational area of the MRS user as feasible. Once radio coverage is met, the MRS is required to meet other technical criteria as determined by engineering objectives, which includes reliability, maintenance, alarm reporting and trouble diagnostics, traffic usage data reporting to assess future planning, and ease of use by the radio user.

While NLH and NP rely on maximum radio coverage of their respective service areas, there is a fundamental difference between each utility in the required functionality of their respective mobile radio requirements. NLH requires that their MRS be the primary method of mobile coverage due the remoteness of their operating areas and the need for inter area coordination (i.e. remote ends of long transmission lines). On the other hand, NP uses cell phone as the primary mode of mobile communications, since NP's primary operating areas are served by cell coverage (i.e. cities, towns, and populated and accessible areas in general). NP's MRS functions as a secondary wireless system, and also functions as a cellular backup communications system, once the appropriate number of mobiles are distributed to those having cell phones.

The above fundamental difference between the NLH MRS and NP MRS requires that NLH technical features be configured for greater availability, ease of use, and system management functions, which are not provided in the MRS proposed by NP's MRS expansion to accommodate NLH – refer to Alternative 3, in the following Section 4.2.

4.2 Alternatives

As directed by the Board, alternatives described in this Section have been examined to meet NLH's operational mobile communications requirements, as discussed in Section 4.1 above. The following discusses the relevant alternatives.

A specific technology has not been chosen to fulfill the requirements of the MRS, rather, the response to an RFI and subsequent questions and clarifications provided sufficient technical information and costing details to assess how the NLH MRS needs can be met and at what cost. After approval of the replacement of the MRS, NLH will prepare a functional specification for a replacement system, which will satisfy its requirements and allow MRS service providers to

propose a solution meeting the requirements. This approach will result in a system that meets all functional requirements at the lowest possible cost through a competitive public tender process.

Alternative 1 – Status Quo – Extension of NLH's existing MRS

The existing MRS was purchased in 1989 and cannot be expanded for a variety of reasons, including:

- All components of the current system are discontinued by the manufacturer;
- Manufacturer support is no longer available to support or to upgrade the software/hardware;
- Spare parts for the switch and site controllers are no longer available;
- The system has experienced an increasing rate of failure in recent years, resulting in reduced availability; and
- Trained resources and training resources, knowledgeable about the system, are no longer available at Aliant, which puts the system at risk. Aliant performs the maintenance on the existing MRS.

The increased failures over the last few years, the unavailability of spare parts and support from the manufacturer, the lack of trained resources, and operational issues with the existing coverage as identified by the user group necessitate the replacement of the existing MRS. Because of the reasons stated above, the alternative of expanding NLH's existing system to allow for implementation of a common system at a future date is not possible or viable.

Alternative 2 – Replace Existing NLH MRS without DTW

Based on the analysis of NLH's identified MRS requirements, it was determined that a total of 39 repeater sites will be required in order to meet the coverage needs of the user group. The existing system has a total of 30 sites. The nine extra sites are required to provide coverage in the following areas, and as identified in NLH User Survey Response – Appendix B:

- Central Newfoundland, to meet the requirements of the Granite Canal Generating Station;
- Bay d'Espoir Highway, to provide infill coverage for the major transmission;
- Southern Labrador, to provide extended coverage along new sections of the Southern Labrador Highway;
- Happy Valley/Goose Bay, to provide local access; and
- Marystown, to provide access to transmission lines on the Burin Peninsula area.

This alternative assumes DTW will not be continuing to participate in the NLH MRS and thus NLH will incur all capital and operating costs.

Alternative 3 – Accommodate NLH on expanded NP MRS

The alternative proposed by NP is to build a system for NLH with the functionality of NP's current system. NP's functionality is a reduced function set from the requirements established by NLH's expansion of NP's existing system and is not an acceptable solution for NLH's mobile communications needs for reasons included in this Section but has been costed for the purposes of this report.

One example of the difference between the NP and NLH MRS technology proposals is in the network configuration. NP's proposal provides for two independent MRS networks. This configuration does not provide for redundancy being available to both utilities at sites that are shared (i.e. as exists now). Under the proposed NP configuration, a failure of one repeater means an outage for one utility. The NLH MRS configuration provides for sharing of the second repeater at common sites such that both repeaters could be used by both utilities, whereby if one repeater failed a second would be available as a standby to both utilities. Also accommodating NLH on an expanded NP system will not provide for interoperability between the utilities. This can only be achieved with an integrated system.

System Management

System Management is an inherent functionality in the existing NLH integrated MRS, as well as the proposed NLH MRS expansion. The proposed NP expansion does not provide system management functionality.

A comparison of the magnitude of NLH's MRS and NP's MRS supports the NLH case for the proposed NLH MRS having extended functionality such as System Management. Contained in the NP MRS requirement submission to NLH in Appendix A (see Attachment 2b, Appendix 'B') is NP's cellular telephone versus mobile radio usage. It is evident from the radio communications activities of NP that their primary mode of wireless voice activity is cell phone usage, with a monthly average ratio of 4.8 to 1 (i.e. cellular/mobile ratio for the randomly selected month of November 2003). The data shows a total of 5191 mobile and cellular calls to the NP System Control Centre (SCC). This data confirms that mobile radio usage is secondary to NP, and is a reasonable alternative based on NP's power distribution activity in urban areas where cell phone service is present.

It is appropriate to indicate here that first responder agencies (i.e. fire police, and ambulance service) recognize that cell phones do not provide the level of access during emergencies since the general public, including news media, parents locating family members, etc. congests this public cellular service.

Although cell phone service is improving, so is demand, and number of subscribers, which results in cellular service providers not guaranteeing subscriber convenient access

under emergency situations (i.e. wind/ice, lightning, heavy snow accumulations, etc.); the latter conditions frequently exist when response of utilities is critical to life safety, critical hospital services, and prevention of industrial losses, due to power outages. By comparison with the NP voice activity above, NLH's MRS is the primary wireless service as quantified in the NLH MRS requirements in Appendix A (see Attachment 2a, Appendix 'B', Circuit Usage Summary). During the same period of November 2003, the NLH MRS processed approximately 14,000 local repeater calls and 162,399 voice and system management polling requests. This analysis confirms the extent of the difference on the reliance both utilities have for a VHF MRS.

NP's existing system, and proposed expansion, does not have remote management capability, which NP considers adequate for supplemental service to cellular usage. Because NLH requires their MRS as a primary means of communications, for reasons outlined above, system management is an essential requirement in order to permit remote diagnostics, troubleshooting, testing and maintenance, without having to travel to remote sites under all weather conditions. It is appropriate to note here that during the RFI process, NLH had considered, and subsequently rejected, a fully redundant MRS alternative proposed due to the higher cost of a redundant system. The semi-redundant MRS was acceptable due to the system management and diagnostics feature capability. The compromise ensured system availability resulting from faster repair response and failure diagnostics afforded by integrated System Management.

Roaming

Roaming is a feature of the integrated NLH MRS, as is System Management, neither feature incurs additional cost. The system proposed by NP does not provide that functionality.

Roaming provides the capability of a mobile user to be found anywhere the user is located within the coverage area of any repeater without having to turn up all repeaters, or group of repeaters, as the NP expansion to include NLH does. Turning up a group of area repeaters, to initiate an 'all-call' to locate a mobile, reduces the ability of a repeater site to handle traffic.

Another important feature of roaming is that the mobile is optimized for radio coverage, since, in overlapping coverage areas between repeaters, it is necessary for the radio to continually switch between repeaters to always avail of the best signal. The latter method is employed in cell phones requiring only the site, in the area of the cell phone user, to be activated, and not multiple sites. In roaming, the mobile is continually sending its location back to the switch, which 'tracks' the location of the mobile automatically and utilizes the best signal source.

The roaming feature provides for improved virtual coverage since the user does not have to 'learn by experience' where the best manual switching locations to access repeaters, having the continuously changing best signal path.

Validation

Federal licensing requires that mobiles do not have access to telephone service outside the Province. NLH requires control in this area since the MRS has access to the telephone network. It is a requirement that valid mobile users have access to the MRS.

In addition to the many other features of system management, the MRS proposed by NLH will have the capability of blocking specific radio access.

Data

With evolving mobility applications, NLH's existing MRS provides for the capability to integrate data applications from selected mobiles. NLH has determined that this feature is still required. An example is the capability to receive a paper copy of Live Line Work and Switching Requests in the field in order to make the process of outages more efficient and minimize the chance of a mistake by a verbal process. While this feature is not utilized at present, it is a desirable feature for a planned system that will operate for the next 15-20 years.

Department of Transportation and Works – A Broader Perspective

NP has stated that should NLH participate as a user of their current system, DTW will not be offered such access. Ultimately this will result in one of two scenarios for DTW: (1) they will use cellular telephones and suffer the resultant loss of coverage and availability during emergencies; or (2) they will procure another MRS from a third party. In either case, there is a loss to DTW in either a level of service or increased costs that, while strictly outside the purview of this analysis, is an important factor when considering this solution. The impact on NLH is that its operating costs would double because DTW is not participating.

Winter emergency response by utilities are generally accompanied by snow clearing services. In the case of NP, these services are in urban areas and are completed generally by the municipality. In the case of NLH areas, snow clearing is done primarily by DTW. The existing and replacement NLH MRS provides mobile interoperability between NLH and DTW, while the NP proposal does not.

The existing mobile interoperability between NLH and DTW has proven an effective mechanism to improved winter emergency response to NLH facilities in the past.

Alternative 4 – Replace Existing NLH MRS and Retain DTW

This alternative is the same as alternative 2 except that DTW will share the capital and operating costs.

In discussions with NLH, DTW has indicated that they are agreeable to utilize whatever expansion NLH provides. Once financial commitments are approved within DTW for participation in the NLH MRS replacement, a Terms of Reference for MRS joint use will be finalized reflecting the shares, and other administrative issues, which form the basis of assumptions contained in this Report.

Alternatives 5, 6 & 7 – Replace Existing NLH MRS to accommodate NP in 2008, 2009 and 2011 and Retain DTW

Should NP participate in the proposed MRS as provided in these Alternatives, the total number of sites will increase from 39 to 52 in the applicable years to meet the requirements of both utilities and DTW. Based on previous discussions with DTW, it is believed that the majority of these additional sites will be of interest to their users, thereby increasing coverage for DTW beyond the requirements of NLH alone. The change in capital cost owing to the shared number of sites model is reflected in the costs estimates illustrated.

4.3 Capital Cost Estimates

This Section discusses the capital costs necessary to complete the economic analysis required by the Board, and for NP and DTW to include in their respective options for making informed future MRS decisions.

The responses to the RFI were used to develop detailed capital cost estimates for the MRS with and without the participation of NP. In all alternatives no additional costs should be incurred by NLH or NP to accommodate DTW.

The total capital cost estimate is $8.39 million for a system without the participation of NP and $10.41 million with NP participating. Tables 1 and 2 below show the estimated proportion of capital cost allocated to each party sharing in a joint system. It is important to note that the individual portions do not sum to the total given above since the total amounts above also include the costs of user radios, maintenance and training that would be borne solely by NLH. Other parties participating in a joint system are expected to be responsible for the procurement of their own user equipment, maintenance and training.

Table 1 - Estimated Capital Cost for NLH-DTW on NLH System - Alternative 4

	NLH	DTW	Total[1]
Number of Sites Used	39	39	78
Proportion of Cost	50%	50%	100%
Capital Cost	$3,592,000	$3,592,000	$7,183,900

[1] Less NLH user equipment

Table 2 - Estimated Capital Cost for Joint NLH-DTW-NP on NLH System

	NLH	DTW	NP	Total
Number of Sites Used	42	50	30	122
Proportion of Cost	34.4%	41.0%	24.6%	100.0%
Capital Cost	$3,168,252	$3,771,729	$2,263,037	$9,203,018

[1] Less NLH user equipment

Tables 1 and 2 are also used in alternatives 5, 6 & 7 (NP joining the NLH MRS). For example in Alternative 7 with NP participating in the NLH MRS in 2011, NP will pay NLH and DTW each $481,441 to contribute to the common existing infrastructure. This will provide NP with access to 17 sites. NP will also have to pay their share of the additional 13 sites they require for a total of 30 sites as noted in Table 2. In the detailed costing information for Alternative 7 in Appendix C, the amount of $204,183 is a net cost made up of $481,441 plus NLH's capital requirements of $277,258 to add 3 additional sites.

4.4 Operating Cost Estimates

The operating costs used in the analysis include the support and maintenance costs based on existing facilities costs, estimated backhaul costs, NLH overhead costs and the annual costs included with the RFI responses from vendors.

As with the capital costs, the NLH portion of operating costs were also apportioned in accordance with the same shares portion associated with number of repeaters used by joint NLH users for the MRS expansion.

Alternative 4 (with DTW) and Alternatives 5,6 & 7 (with DTW and NP) operating costs are summarized in Table 3, below.

Table 3 - Annual Operating Costs used in NPV Analysis Comparisons as indicated

Description	NLH Site Usage	DTW Site Usage	NP Site Usage	Total Site Usage
NLH and DTW on NLH replacement MRS				
Number of Shares (Sites used)	39	39	0	78
Percentage of Shares	50 %	50 %	0 %	100 %
Allocated Annual Operating Costs	**$ 458,559**	**$ 458,559**	**0**	**$ 917,118**
NLH, DTW, and NP on NLH replacement MRS				
Number of Shares (Sites used)	42	50	30	122
Percentage of Shares	34.4 %	41.0 %	24.6 %	100 %
Allocated Annual Operating Costs	**$ 471,378**	**$ 561,817**	**$ 337,090**	**$ 1,370,285**

4.5 Economic Analysis

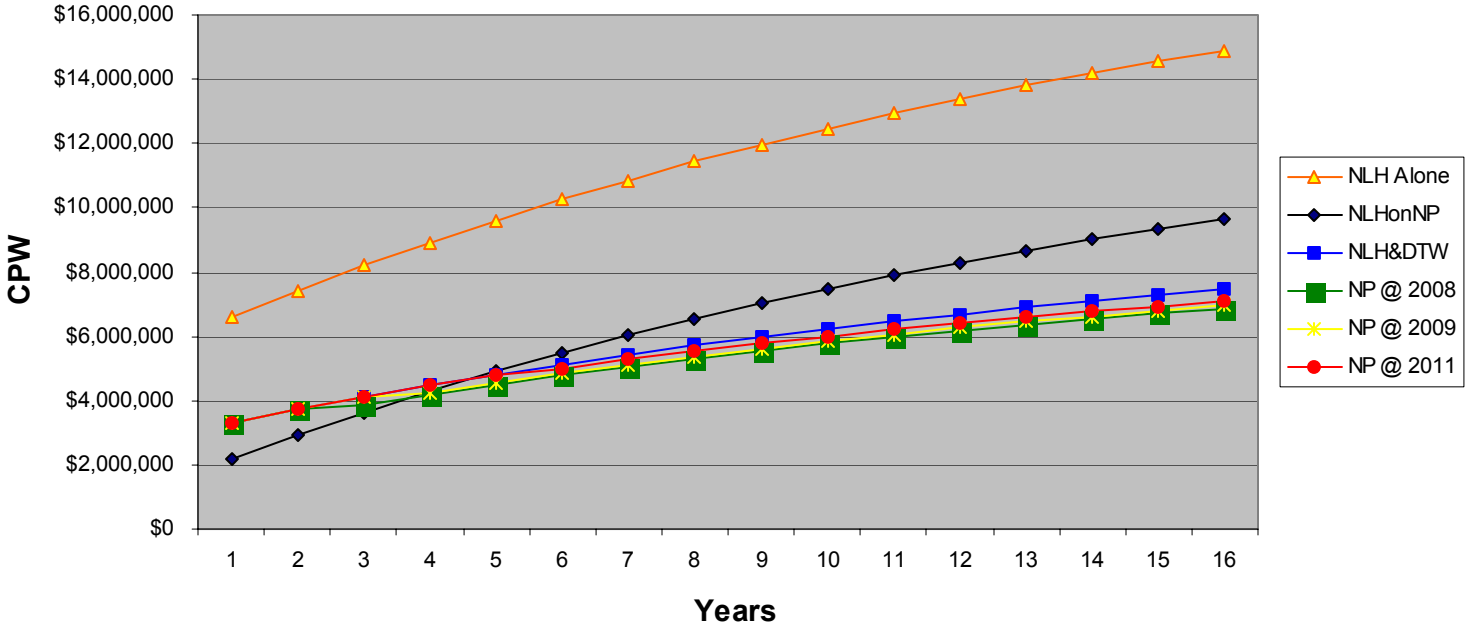
In accordance with the Order, an economic analysis was completed to assess the implications of the proposed alternatives. The NLH comparisons completed are shown in terms of cumulative present worth (CPW). The following graph illustrates the CPW for each alternative with the exception of Alternative 1.

The CPW calculations are summarized in Table 4 and Graph 1 below. Note that this summary does not include the capital required for NLH user equipment. The detailed CPW analysis is summarized in Appendix C.

Table 4 - Results of NLH CPW Analysis (refer to Summary Sheets of Appendix C)

Alternative	Cumulative Present Worth ($M)
1. Expand NLH Existing System	Not Technically Possible
2. NLH alone on replacement NLH MRS	$14.895
3. Accommodating NLH on expanded NP MRS	$9.660
4. NLH and DTW on replacement NLH MRS	$7.448
5. NP joins NLH and DTW on NLH replacement MRS in 2008	$6.858
6. NP joins NLH and DTW on NLH replacement MRS in 2009	$6.942
7. NP joining NLH and DTW on NLH replacement MRS in 2011	$7.090

Chart 1



The above results indicate that NLH, DTW and NP sharing the NLH MRS replacement is the least cost alternative for NLH; whether it be NP joining in year 2, 3 or 5.

The second most economical option is for NLH and DTW to share the NLH replacement system.

Overall it is clear, given that NP does not need to replace their system at this time, the logical way to ensure least cost is for Hydro to replace its existing system, include DTW in the system, and allow for the possible integration of NP at a later date.

APPENDIX A

Mobile Radio System

Request for Information

Technical Specification

Mobile Radio System
Request for Information
Newfoundland and Labrador Hydro
Technical Specification

2004 April 06

PROVINCE OF NEWFOUNDLAND
PERMIT HOLDER
CLASS "A"
This Permit Allows
CUSTOM SYSTEMS ELECTRONICS LIMITED
X0136
To practice Professional Engineering
in Newfoundland and Labrador.
Permit No. as issued by APEGN
which is valid for the year 2004

Prepared for: Newfoundland & Labrador Hydro
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P.O. Box 13610
St. John's, NL A1B 4G1

REGISTERED PROFESSIONAL ENGINEER
Norman B. Cook
SIGNATURE
2004 April 06
PROVINCE OF NEWFOUNDLAND

File:NLHMRS.Spec.Final.COVER

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1.0 Introduction

1.1 Purpose

The purpose of this Request for Information (RFI), is twofold, as follows:

1. To determine available technology solutions for a) replacement of existing mobile radio system (MRS) of Newfoundland and Labrador Hydro (NLH), with b) an Option B to add the MRS of Newfoundland Power Inc. following installation of the NLH MRS.

2. To receive budgetary costs of available technologies to update current engineering estimates. The estimates shall be used for presentation to the Public Utilities Board (PUB) for approval of capital and operating expenses to implement the replacement of the existing MRS.

1.2. General

Newfoundland and Labrador Hydro (NLH) is the Province's primary power generation and high voltage distribution utility (Crown Corporation), while Newfoundland Power Inc. (NPI) is the Province's privately owned distribution utility, which serves more centralized populated areas. Both NLH and NPI are required to obtain PUB approval for capital and operations budgets, which inevitably effect utility rate charges to customers.

NLH has an aged Mobile Radio System (MRS) that requires replacement. The MRS is shown as **Attachment 1a – Block Diagram Existing NLH MRS.**

The existing NLH MRS is accessed by the Provincial Government's Department of Transportation and Works (herein referred to as "the Department") whereby the Department is responsible for all costs of their user equipment. No costs are anticipated in response to the Request for Information (RFI) associated with the Department on the new MRS. NLH shall be responsible for adding repeaters to accommodate future changes in traffic associated with the Department's user activity. It is required, however, that sufficient switch ports be available to expand the numbers of repeaters at any site, or to expand the number of sites. **The Vendor shall indicate expansion capability of the proposed system.**

To meet the requirements of the PUB Order 29, NLH is issuing this RFI to which suppliers shall provide a quotation to replace the MRS, and to provide an option (Option B) for replacement of the NPI MRS, in increments of 2, 3, and 5 years, to coincide with anticipated replacement of NPI's existing MRS consistent with the end of its service life. The NPI MRS is shown in **Attachment 1b – Block Diagram Existing NPI MRS**.

The major differences between the NLH and NPI MRS networks are as follows:

1. The NLH MRS has separate links, which connect the central switch to each of 29 repeater sites; NPI has repeater connectivity whereby groups of sites are connected in nine (9) individual operational regions, which is possible because it fits the operating philosophy of NPI – refer to Attachment 2 Appendix B – Traffic Data (2003 November).

2. NLH uses the MRS as a prime communications facility, while NPI utilizes cell phones as their prime communications mode with their MRS as an emergency backup communications network.

3. NPI requirements for mobile communications are primarily in more populated Island areas, while NLH must maintain remote transmission lines spanning interior wilderness areas of the Province, including the Northern Peninsula and Labrador.

Both NLH and NPI utilize a central switch for mobile radios calling their respective control centres using DTMF equipped radios. The NLH control centre is referred to as the Energy Control Centre (ECC) located in St. John's, NL; the NPI control centre is referred to as the System Control Centre (SCC) and is located in Mount Pearl, NL, about 5 km from the NLH ECC.

This RFI shall provide all costs to provision a turn key installation to NLH, including, but not limited to, all capital costs, including engineering, factory testing, shipping (FOB applicable sites), installation, spares, training, technical documentation, wiring lists, and associated annual operating costs. The NLH MRS switch replacement is intended as the initial phase. Vendors shall assume that annual backhaul facility costs are not included and shall be determined by NLH/NPI as appropriate, except that terminal components required for connection to the radio equipment with backhaul facilities shall be identified. The Vendor shall also provision for maintenance facilities in Western, Central, and Eastern areas of the Island, with Labrador being serviced from the Western, or Central facility as a minimum requirement.

It is recognized that manufacturers may provide diverse mobile radio system solutions based on current technology alternatives. It is the intent of this RFI not to limit, or otherwise prevent, various technology solutions from being considered. It is the intent to select an open standard technology solution, which accommodates competitive bidding. A list of VHF user equipment is required in the quotation format found as **Attachment 4 – MRS Replacement Costs**. Evaluation information is provided in **Section 15 – Quotation**, to provide Vendors with a common format to permit NLH a convenient comparison.

RFI completion using **Attachment 4 – MRS Replacement Costs with NPI (Option B)** is a mandatory requirement of this RFI, since it facilitates site by site evaluation, in case costs associated with access for site installations appear too varied amongst vendors thereby requiring assumption adjustments. A softcopy of Attachment 4 provides for improved viewing, and cell reference for queries relating to specific cell content. A separate sheet may be used to provide more detail to costs and/or assumptions for cell amounts. (The separate sheet shall have the cell ID, e.g. G37, shown in the upper right area of the detail page and referring to Mary March Hill Existing Tower information).

In concert with Attachment 4, point-by-point response to this document is required to allow an efficient review of each Vendor's information.

2.0 System Overview

2.1 General

The system overview of each Utilities' Existing Mobile Radio System (MRS) is found in **Attachment 2a. – Existing NLH MRS, and Attachment 2b – Existing NPI MRS (Option B quotation for future requirements outlined therein)**

The Attachment 2 documents describe each Utilities' MRS systems in detail.

The proposed MRS accommodating NLH and NPI replacement shall function, as a minimum requirement, similar to the existing MRS operation of both utilities, except as otherwise described in this RFI.

2.1 Newfoundland & Labrador Hydro MRS Replacement Considerations

The existing NLH MRS consists of an MRS switch in Aliant's (Telco) Central Office, Gander, NL, connected to 29 repeater sites on the Island portion of Newfoundland and Labrador. In addition, there is one (1) standalone repeater site in each of Labrador City/Wabush and Happy Valley/Goose Bay, Labrador; the existing sites are not connected to the existing MRS Switch. There should be provision made to connect to the new MRS technology.

The switch is the critical component to be initially replaced due to its unreliability. The initial switch replacement provides for a phased NLH MRS upgrade depending on the technical assessment of the implementation and associated costs. It is anticipated that this RFI process will determine the feasibility of upgrading the switch in Phase 1 and changing repeaters & user equipment in other phases. Vendors are not limited to proposing repeater equipment replacement simultaneous with redundant switch replacement if this is the most feasible alternative, provided any required scheduled site

space and power infrastructure changes/additions by others accommodate simultaneous implementation.

Currently, 26 of 29 NLH Island repeater sites are located in Aliant radio sites, with backhaul facilities, between the MRS repeater sites and the Gander Switch, being rented from Aliant. Attachment 2, in Appendix E provides for relocation of repeater equipment to the new NLH microwave sites for the MRS replacement for both utilities. There are currently a few joint site selections pending review. Any changes to the sites will be issued in an Addendum to this Specification. Unless addendums are issued, the site connections to the new MRS are designated in Attachment 4 – refer to the at the bottom of Column B – "X" indicates this is a new NLH connection and "B" indicates this site is to be considered in the Option B addition of NPI. If "X" & "B" are shown in the Column B for the same site, assume one (1) repeater is to be provided.

The upgraded NLH microwave network – **refer to Attachment 3 – NLH Microwave Facility** - connects Deer Lake, NL, in the west and Bay D'Espoir, NL, in the south with the NLH Energy Control Centre in their Head Office, St. John's, NL. The new microwave sites, some of which were upgraded existing microwave sites, were also designed to accommodate MRS repeaters to relieve NLH of having to utilize third party sites and backhaul circuits rental costs. The new NLH microwave network has ample building, power, tower, and microwave bandwidth capacity to backhaul any MRS traffic resulting in reduced third party charges for operating the MRS network. In addition, if Option B (sharing with NPI) proves to be feasible, there will be a number of NPI sites that also will reduce third party MRS rentals (i.e. site, building, power, and tower costs, third party backhaul will remain).

2.2 Newfoundland Power Inc. MRS Replacement Considerations

The existing NPI MRS consists of a mobile radio switch located at the System Control Centre (SCC), Mount Pearl (adjacent community to the City of St. John's, NL) – **refer to Attachments 2b – NPI MRS Requirements Appendix "D (Option B)**. Backhaul between NPI identified sites and existing MRS switch is linked via analog voice (VoIP) channels on their Province-wide Area Network (WAN) with MRS voice channels having priority of transmission. **The NPI upgrade (Option B) will maintain MRS operation as exists and shall be included as Sheet 2 of 2 of the completed Attachment 4 – Quotation Format sheet.**

3.0 VHF Repeater Sites

3.1 General

As referenced in Section 2.0 above, repeater sites have been selected based on a joint review of both NLH and NPI existing sites, as well as required future sites. **Attachments 2** includes **Appendix E - List of Repeater Sites**, resulting from a detailed MRS computer modeling of sites required by both NLH and NPI. The integration of both utilities' sites shall provide for the requirements of the Option B MRS configuration (Note: the Option B configuration will not provide for NLH and NPI existing at all sites, as shown in **Attachment 4 – MRS Replacement Costs, Column B**). The RFI will include turnkey costs of supplying the MRS between a central, or distributed switch, to the sites indicated, and including user equipment quantities also specified in Attachment 2. **The Vendor is not responsible for cost of backhaul links between sites and switch, or control centres of either utility**. The Vendor is required to specify what backhaul facilities (i.e. T1, T0, 4W E&M, and the quantity, etc.) are required – refer to Attachment 4, Columns M, N, & O)

3.2 Coverage

The Vendor is not responsible for MRS coverage area, with the exception of a deficiencies resulting from equipment workmanship, or installation, of the supplied system. Confirmation of coverage will be completed during commissioning of the supplied MRS by field strength measurement.

3.3 Site Maintenance and Access

The Vendor shall assume that building access arrangements will be provided to both utilities' owned site; however, Vendors shall make arrangements with third party site owners (primarily Aliant) for site rental and access for maintenance requirements of this RFI. Third party site access, and rental costs, shall be negotiated, if required, with either utilities' assistance, as necessary.

Maintenance costs may be quoted based on a standing offer, whereby hourly rates are quoted with estimates provided on a site-by site basis based on travel method, travel time, and access based on seasonal conditions. A five (5) year maintenance plan with option to renew for 5 years shall be provided in the quotation. Vendors' service centres shall be available for the future MRS support in Eastern, Central, and Western, NL as a minimum requirement.

4.0 NLH Microwave Facilities

Replacement of the existing MRS requires that optimum use of the existing NLH microwave network be implemented – refer to **Attachment 3 – NLH Microwave System – Block Diagram**, including installation of MRS equipment, and use of the NLH microwave for backhaul to the MRS redundant switch. The Vendor shall assume that adequate backhaul facilities exist at all NLH microwave sites identified herein, which accommodate any proposed MRS repeater replacement. **Attachments 2a – NLH & 2b – NPI, Appendices E** identify sites by ownership of the utilities, as well as third parties. Third party sites are comprised primarily of those owned by Aliant Telecom. It is recognized that in many cases Aliant Telecom sites will still be required due to their strategic location for mobile coverage requirements of both utilities. In addition, all NPI sites remaining at NPI, or Aliant, owned sites will assume to retain Aliant backhaul facilities for this RFI; point-to-point links between third party sites adjacent to NLH microwave sites, may be considered at a later date, to replace rented backhaul facilities.

In cases where Aliant sites are identified, costs of site rental and access required for installation and annual maintenance shall be added to vendor costs by NLH and NPI, and following receipt of the Vendor response to the RFI.

In cases where NLH sites are identified in Attachment 4, Column B & C, new MRS repeaters shall be located at NLH microwave sites specified in Attachment 2, Appendix E. The Vendor is requested to confirm the final site list prior to responding to this RFI.

5.0 Backhaul Links & Traffic Data

Backhaul capacity is defined in bandwidth, T1, fractional T1 (T0), or voice grade analog circuit quantities from the sites to the switches. The requirement to support the MRS will depend on the technology solution proposed by the Vendor in the RFI response.

NLH MRS backhaul links are currently rented from Aliant Communications, with the exception of a few MRS repeaters located at existing NLH microwave sites. The intent is to utilize new NLH-owned microwave sites to accommodate the new MRS repeaters identified in **Attachment 2a – Appendix E - List of new NLH MRS sites**.

NLH has T1 capacity to provide backhaul from their microwave sites to the redundant, or distributed, switch locations, where NLH-owned microwave sites are used for MRS. Multiplexer interfaces with T1 shall be required, and costs provided in Attachment 4 , Columns M, N, & O, as applicable to provide the necessary DS0/T0 (T zero) 64 kbps circuits for repeater system interface.

NPI MRS (Options B costing) backhaul is currently a Frame Relay WAN using Motorola 6520 voice capable routers; when this MRS upgrade is installed it is anticipated that a new configuration, using a broadband and Frame Relay Hybrid Network using Cisco 3720 voice capable router, will be installed. It is anticipated that the latter backhaul configuration will remain with the quotation Option B; unless the Vendor technology solution proposes a better, cost effective solution. The latter backhaul solution may also be used for NLH, however the standard used for VoIP shall be ETSI TR 102 129 latest revision.

A random sample of traffic information is included in **Attachments 2a Appendix B – NLH and 2b Appendix B – NPI (Option b)** to assess both utilities' existing MRS day-to-day voice usage.

Traffic in Attachment 2a Appendix B includes existing NLH and Department traffic only; NPI traffic in Attachment 2b Appendix B must be added for sites, which are to be shared with NLH (i.e. Option B costing). It is recognized that emergency usage will be higher because of the number of field personnel of NLH, the Department and NPI increasing in emergency situations (e.g. icing conditions, which cause damage to power lines, etc.) since all their operations may peak simultaneously under emergency conditions.

Since it is difficult to quantify MRS traffic under emergency conditions, and since traffic measurement is a required feature of the MRS, a Grade of Service (GOS) factor of 5% busy-hour blockage is used to define the necessary access requirement, with the result that future repeaters may have to be added at a given site in the event the minimum GOS is exceeded (i.e. during regular operations, or emergency conditions, whichever is worse). The MRS proposed shall be configured to accept additional site repeaters such that shelf wiring is not required for the additional repeaters, however, plug in cards shall be the only addition required.

It is estimated that the initial installation shall require a single repeater, with a couple of sites requiring a maximum of three (3) repeaters. The Vendor shall describe the additional requirement should one (1) to three (3) additional repeaters be added at the proposed site configuration.

6.0 MRS Coverage

Coverage and access are the two most important parameters defining a MRS.

A list of repeater sites is found in **Attachment 2 – Descriptions of Operation, Appendix E**.

Attachment 2, together with the included site location maps of Figures 1, shows the locations of both NLH and NPI repeater sites. The locations of these sites have been reviewed by both NLH and NPI engineers, in Appendix E, and, for this RFI, are assumed to be the sites at which the MRS upgrade repeaters will be located.

Since radio coverage is predetermined by the prior site selection **Attachments 2a & 2b - Appendices E,** coverage is not the responsibility of the Vendor, unless the Vendor proposes alternate site(s), to those selected.

Vendors who wish to propose alternate sites shall enclose coverage maps, acceptable to NLH; the proposed site(s) shall be analyzed for coverage with transmission parameters provided by NLH's Consulting Engineer.

7.0 Grade of Service (GOS) Requirement

In a shared MRS, it shall be assumed that joint users shall have equal access to a repeater. Priority access shall not be required, since there will single repeaters at the less used sites or sites anticipated with low traffic activity. A feature to interrupt a repeater transmission in progress shall be discussed for feasibility by the Vendor, as this feature would utilize a button on the user equipment, which allows a transmission for emergency response.

The reference traffic data used for review of operational requirements of both NLH and NPI MRS Networks has been selected to be 2003 November – **refer to Attachment 2 Appendix B – Traffic Data (2003 November)**.

Although the traffic activity shown in Attachment 2 Appendix B is assumed to be typical for purposes of this RFI requirement, it is recognized that, during local emergencies, the traffic may increase significantly. For site specific activity (e.g. ice storm, in which a power line(s) may be severed), there would be more local repeater activity.

Grade of Service (GOS) is defined in terms of the number of calls blocked in a number of attempts during the busy hour (e.g. five (5) calls blocked in 100 attempts represents a Grade of Service of 5%). Assume one (1) repeater for each site but provide wired shelves to accommodate three (3) repeaters, minimum, per site.

Referring to Attachments 2 Appendix B, the Grades of Service (2003 November month), under regular operating conditions is extremely good.

For purposes of this Specification, it is reasonable to require a repeater, or MRS, GOS of 5% specified during emergency MRS situations, representing 'busy hour'.

NPI - Option B

The GOS of 5% shall also be required if Option B (NPI MRS) is implemented; this may necessitate the addition of repeaters at selected sites. For RFI purposes, it will be sufficient to provide a quotation for the addition of a site repeater, associated switch costs, and to identify additional backhaul link requirements, as specified.

8.0 System Management and Alarms

The Vendor shall include costs to provide system management and alarm system providing for maintenance monitoring and control from two (2) locations: i) St. John's, NL, and ii) Deer Lake, NL.

Alarm reporting shall include major and minor switch and repeater alarms including, but not limited to, ac/dc power failure, link disconnect failure, ac/dc/generator set site power transfer status, high return loss, TX failure, site security, etc. Please provide a list, or number of analog and digital (dry closure) alarm point capability.

9.0 Equipment Requirements

9.1 Switch

The switch may be distributed, or redundant. Assume St. John's ECC and Deer Lake as the redundant switch locations.

Redundancy means either located at two (2) independent switches capable of controlling all MRS sites, or at a single location and utilizing redundant power supply and redundant central processing sections.

The switch shall be CSA and ULC approved for use in Canada.

A UPS power supply shall be included which has an integral data circuit and an open system applications software package, which monitors the switched health and status.

The switch shall also have a maintenance port to allow for remote interrogation, troubleshooting, and reprogramming (updating), as indicated in the Vendor's response to this RFI.

9.2 Repeater & Controller

The repeater shall be type approved by Industry Canada; the type approval number shall be provided. – Refer to Attachment 4, Columns Y & Z for all VHF radio types.

The repeaters/controllers shall be E.I.A. 19" rack mounted, and replacement modules shall be easily changed with card edge and motherboard having gold contacts.

The repeater shall be rated continuous100 W operation minimum, and shall be adjustable down to 25 W without degradation of specifications.

Vendor to supply power consumption specifications applicable to all equipment quoted.

Operating temperature range of site equipment shall be -30ºC to +50ºC.

Repeaters shall be capable of operation in the full VHF band indicated in the Attachments, split VHF band tuning of repeaters is acceptable, and shall be capable of operation in both 12.5 kHz and 25 kHz bandwidth on a per channel basis. This allows a mix of older 25 kHz operation as well as 12.5 kHz operation based on which user equipment bandwidth is used.

CTCSS, or equivalent non-proprietary protocol method, shall be used with carrier sense, to open the squelch of the repeater.

DC-DC Converters shall be supplied for conversion of battery supply to +12 VDC power supply of repeaters & associated controllers where a 12 VDC plant is unavailable.

9.3 Antenna System

Antenna filtering shall be provided to allow for site expansion using other VHF radios with TX separated by a minimum of 300 kHz without degradation of TX harmonic generation or receiver sensitivity.

Andrew LDF5-50A, or equal transmission line, shall be supplied, with specifications provided for the alternate.

Antennas shall be Sinclair SRL210-C4, or equal. Specifications shall be provided if antenna is substituted.

Antenna system hardware, and accessories, including, but not limited to, connectors, tower mounting hardware, brackets, and sealing kits shall be in accordance with the antenna manufacturers recommendations. All hardware shall be included in quotation.

9.4 Rack Mounting

Repeaters, controllers, and antenna filtering, and associated equipment shall be wired and Rack-mounted in standard E.I.A 19" racks prior to factory testing.

The switch and all other associated equipment shall also be rack-mounted in standard E.I.A. 19" racks, provide details if alternate mounting is proposed. Vendor shall supply specifications and sketches of equipment with RFI response. Specify standard rack heights used, provide drawing, or sketch.

The Vendor is advised that third party rack mount height dimensions, and grounding/cable tray interfacing standards, may not be consistent with NLH rack configurations. Provision in the quotation shall be made for variations.

The Vendor shall assume that a new battery plant, rectifier (charger) and DC panel with alarm contacts, will be required in third party sites. A minimum 36-hour backup power interval is required assuming a 48 VDC supply at 1.5 amps continuous.

10.0 Technical Support

The Vendor shall supply all modes of technical support available for each product quoted in response to the RFI.

The modes of technical support may be including, but not limited to, one (1), or more, of the following:

1. Internet webpage support and downloads.
2. CD information.
3. 1 -800 access to technical support indicating times available.
4. Local area technical support.
5. Remote access by manufacturer to equipment for troubleshooting.
6. Faxback information.

The Vendor shall supply a procedure to be followed by the customers technical staff for internal failure of each piece of equipment in the indicated locations by referring on a separate page to each by column/row shown i.e.: (e.g. C4 portable, below, at Deer Lake). Indicate the estimated Mean Time to Repair (MTTR) for each equipment type identified (Note: MTTR includes site access time, please indicate time data used).

		A East, NL	B Central, NL	C West, NL	D Labrador
1.	Switch		N/A*		N/A*
2.	Repeater/Controller				
3.	Mobile radio				
4.	Portable radio				
5.	Base Station				
6.	Antenna System				

"*" N/A – not applicable, applies to a non-distributed switch only. Indicate all distributed switch service procedures by area (i.e. east, central, west, Labrador).

Wiring lists shall be provided as part of documentation provided with supply of equipment.

11.0 Spares

A spare parts list and procedure for repair of each equipment type shall be included with system delivery, and provided as a hardcopy service manual for each service location.

A single set of switch spares; 5% spare user equipment units or 1 spare of any equipment (minimum); manufacturer recommended plug in card spares as applicable.

Include costs for the recommended spares in the list.

Indicate where the nearest spare will be sourced, in the event the spare needs replacement, and the required procedure to be followed for replacement.

12.0 Documentation

Vendors shall provide documentation, suitable for a thorough engineering evaluation, in response to this RFI.

The requirement for standard MS Windows software shall be supported by a migration path for future upgrades, up to, but not limited to the MS Windows XP operating system.

Include the costs of two (2) complete sets of hardcopy service manuals, including hard and soft copy documentation required for field maintenance. All troubleshooting software, including but not limited to programming of main switches, repeaters, repeater controller, alarm and system management system will be required for the delivered MRS.

Indicate websites where upgraded documentation can be accessed, and provide costs of annual upgrades associated with any equipment for which costs are provided.

13.0 Training

13.1 Documentation – Hard & Soft Copy

Training shall be completed prior to or during commissioning of the system. All documentation, including wiring lists, and each type of equipment and applicable software, shall be part of the training material provided.

Training costs shall be specified in terms of equipment type, locations, and number of technical and operations staff.

13.2 Locations – Technical Staff

Training locations shall be St. John's, NL and Deer Lake, NL. Vendor shall provide training costs for a group of ten (10) technicians, and/or the recommended maximum per class.

User equipment training – refer to Section 13.4 below, shall be in Deer Lake, Bishop's Falls, and St. John's, NL. NLH shall provide necessary space and facilities with Option B training required as options in Corner Brook, Gander, and Clarenville.

13.3 Equipment Type

Technical training shall be provided for the following equipment type:

- Redundant, or distribute switches.
- Repeater/Repeater Controllers.
- System Management and Alarm Software (MS Windows compatible PCs).
- User Equipment Programming & First Line Maintenance.
- Customer to be provided with training to complete first line maintenance such as broken antennas, microphone cords, after market PCB installation as required for user equipment, which requires off-the-shelf modifications.
- Antenna system components.
- Other network equipment as required by customer.

13.4 User Equipment

User training shall be provided for the following equipment type:

- Mobile Radios

- Portable Radios
- Base Station Radios

A users manual shall be provided for each registered trainee.

14.0 Implementation

A brief Statement of Work (SOW), in Microsoft Project 2000, Excel, or generic format, shall be included with the quotation, and in response to the RFI, which shall include the responsibilities of all parties in a future turnkey project. The SOW shall summarize the list of tasks, provide the anticipated timeline of events to complete the engineering design, manufacture, factory test, supply and travel time, switch changeover/parallel operation, installation, project management, document preparation, training, and the overall implementation of the project.

The critical, and initial, supply and installation shall be transfer of the existing switch to a new switch. Following this milestone, the MRS can be supplied in phases as proposed in the SOW. Alternately, the Vendor may wish to propose an option of operating a parallel old/new MRS, however, building space & the logistics of coordinating this at third party sites may limit this arrangement to using NLH sites only. The latter arrangement would provide for a 'burn-in' period for the switch and newly installed repeater systems.

A SOW schedule should allow time for meetings, project management negotiations with Aliant for third party site use, agreement on terms of references (i.e. site access, etc.)

15.0 Quotation – Format & Reference to Information Instructions

This RFI describes the MRS Replacement in terms of deliverables that shall be included in response to the RFI as well as deliverables that are to be provided with the MRS delivery. It should be obvious to the Vendor which documentation and information is required in response to the RFI, as opposed to documentation which is to be included with actual MRS delivery. To assist the Vendor in preparation of the quotation portion of the RFI, Attachment 5 a), b), and c) is included "For Information Only" to assist the Vendor in including costs associated with actual project implementation. The project implementation costs may normally be included in response to an RFI in the form of risk, or overhead, percentages or amounts. Attachments 5 are intended to provide additional information on the actual structure of the final project, thereby allowing a more realistic quotation by the Vendor, rather than an optimistic quotation.

The quotation shall be formatted to permit evaluation of responses in a convenient manner. A spreadsheet, formatted in MS Excel^{SM} *.xls, shall be submitted with costs

identified on a site by site basis with Task Description shown in the left column and cost categories as described in the first row below the Title – Refer to Attachment 4, which is available to Vendors, in softcopy. The final selected sites for the new MRS are included in **Attachment 4 – Quotation Format**, representing the **Attachment 2 - Appendix E Final Site selection by NLH and NPI,** the Vendor must refer to the Column B to determine the final sites, which have an "X" for NLH new sites, and "B" NPI Option B, added repeaters/sites, as indicated.

The Vendor shall supply incremental costs for any feature pack offerings that may be considered to make the MRS more functional. Vendor may make a separate list by adding sheet 3 to Attachment 4 – Quotation Format response.

The above format provides for a consistent method to evaluate RFI responses, and to evaluate Option B, the cost option to increment the NLH MRS to include the NPI MRS integration.

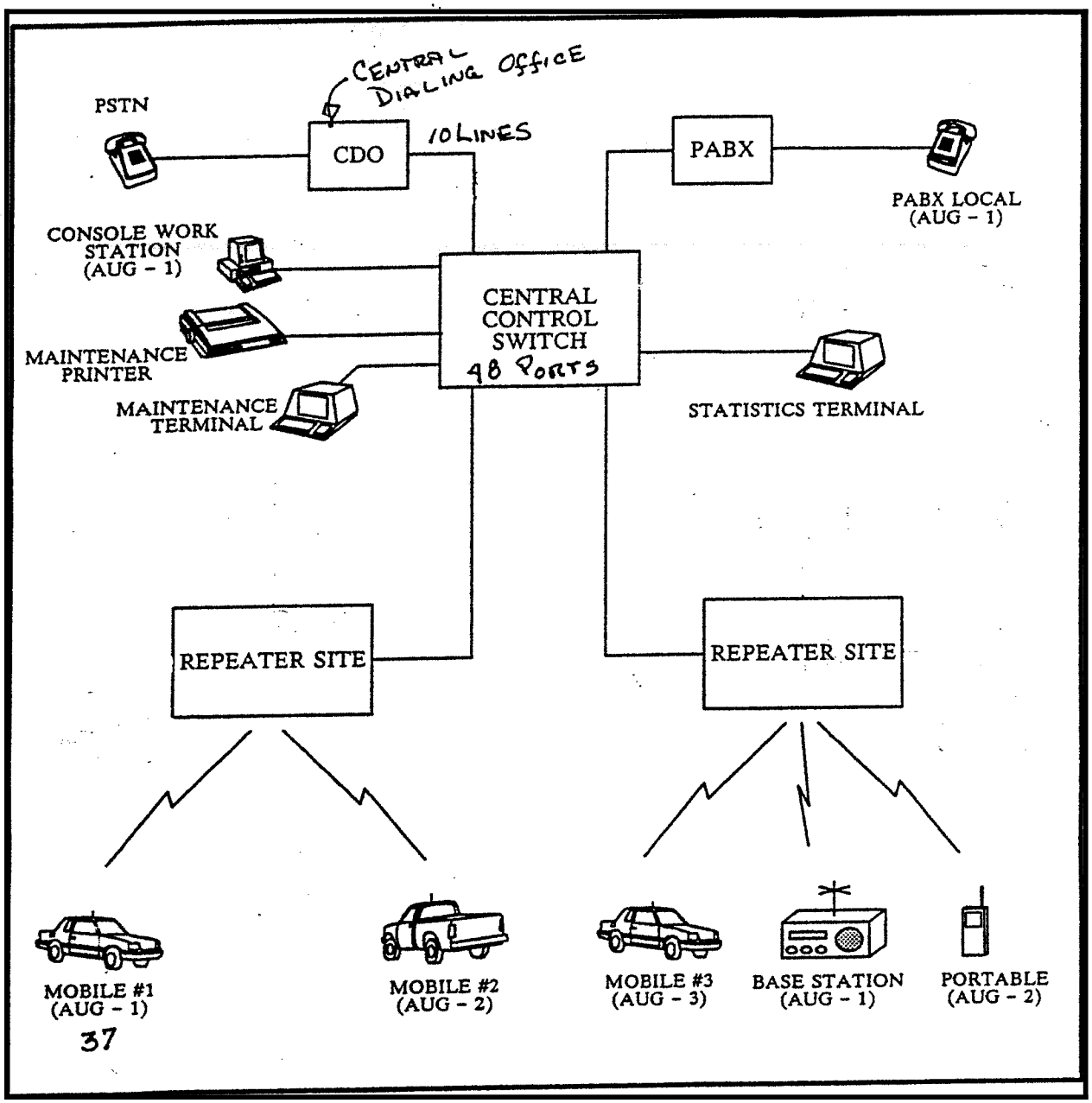


FIGURE 1.6 GENERAL SYSTEM BLOCK DIAGRAM

NOTES: 1. AUG = ASSIGNED USER GROUP

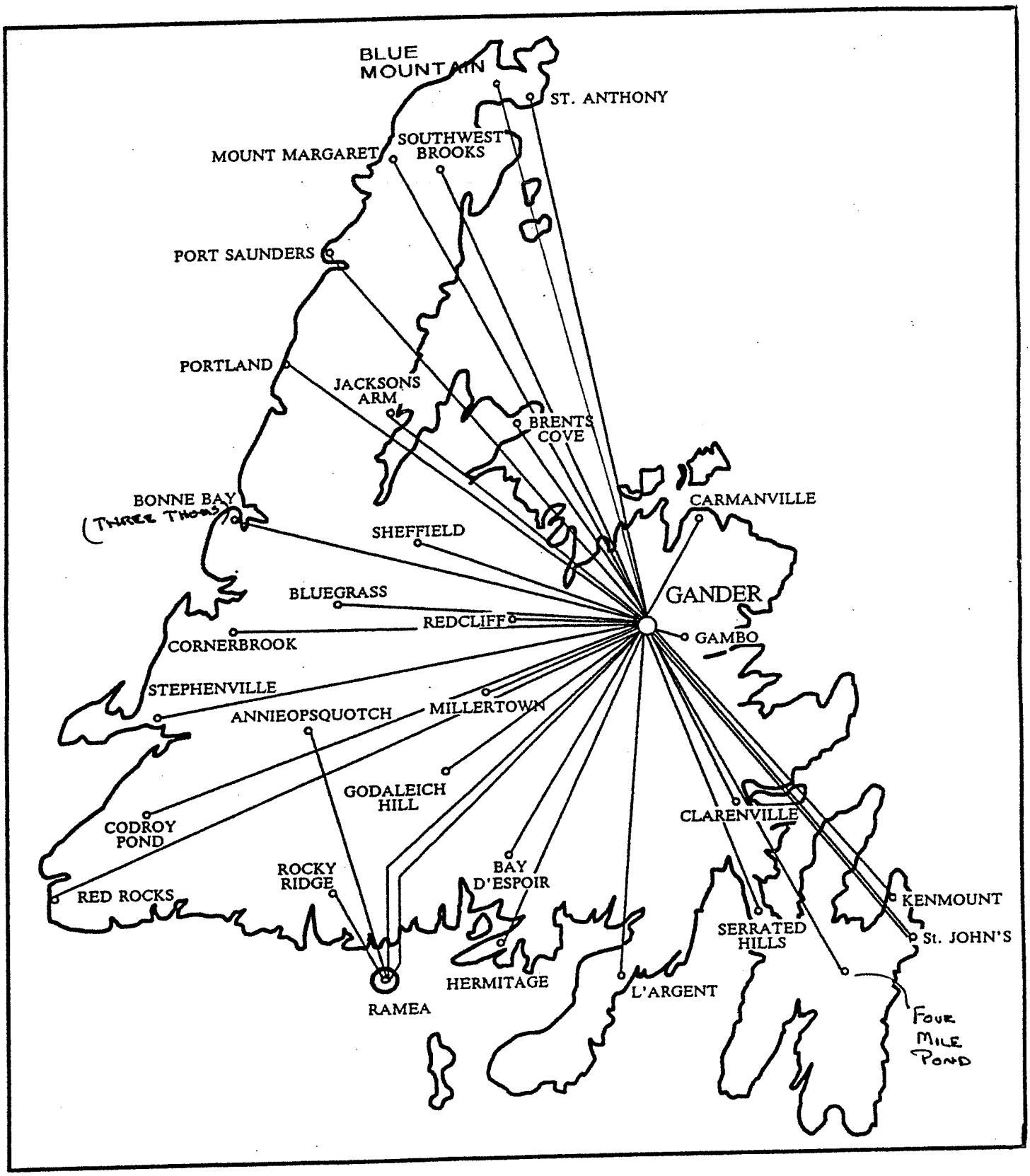
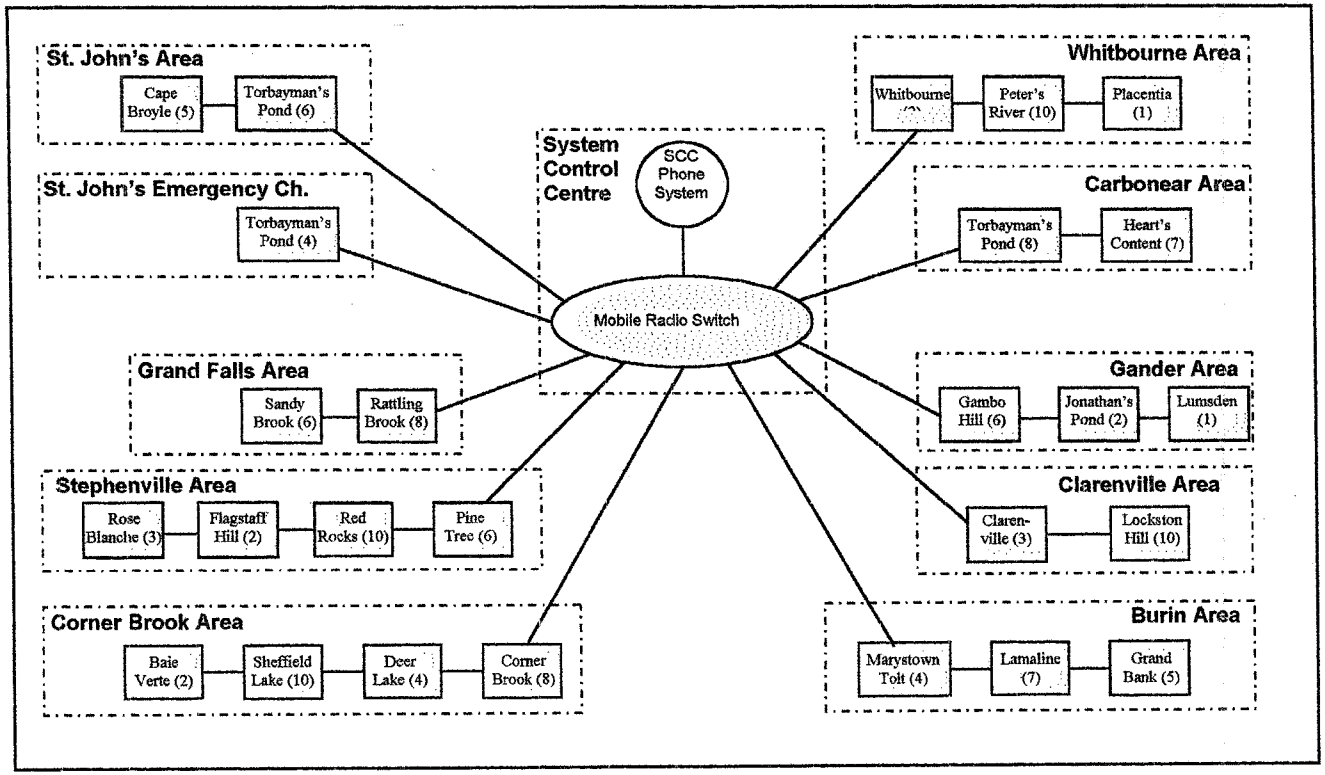


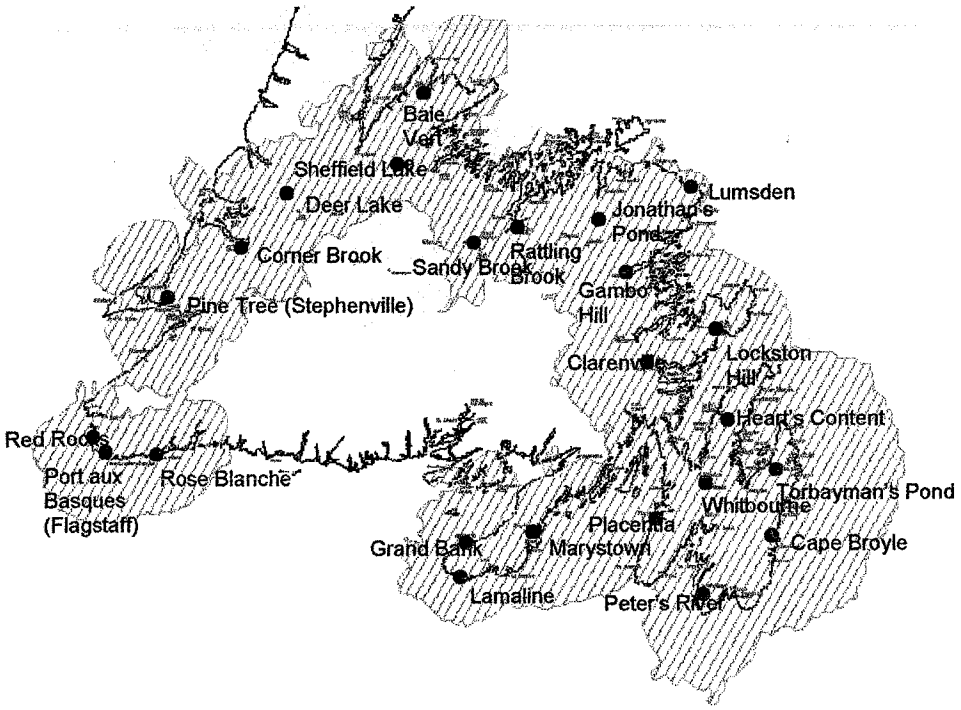
FIGURE 1.8 NEWFOUNDLAND SITE LOCATIONS



NPI – Present Radio System Areas

ATTACHMENT 1b

ATTACHMENT 1b

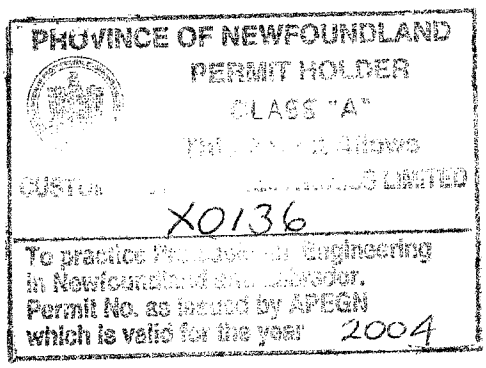


Present VHF Radio Coverage

ATTACHMENT 2a

Newfoundland Hydro Mobile Radio Requirements

2004 March 06



Prepared by: Norm Cook, P.Eng.
Date: 2004 March 06
Version: Final

Table of Contents

1.0 Executive Summary

This Report describes the Newfoundland & Labrador Hydro (NLH) Mobile Radio System (MRS) to facilitate the consideration of Newfoundland Power Incorporated (NPI) to integrate NLH requirements into future expansion of the NPI MRS. The reader will note that this Report format mirrors, for reader convenience, a reciprocal Report wherein NPI provides their current and future MRS requirements to NLH for consideration of NLH to integrate NPI MRS requirements into the currently planned NLH MRS.

In accordance with Public Utility Board Order 29 (2003) both utilities are required to evaluate their respective MRS expansion needs towards determining if there is common ground to minimize the future cost of ownership of MRS infrastructure through some sharing arrangement, and based on the least net present value (NPV) economic indicator.

NLH is responsible for primary power generation and distribution throughout the Island and Labrador, and includes some low voltage distribution in very remote areas (TRO), consequently, MRS coverage requirements extend into remote wilderness areas. In comparison, NPI provides services to the more populated areas along the main highway routes, as evidenced by MRS radio coverage maps. Consequently, NLH's need for reliable radio service, including extended radio coverage, is much greater than NPI. Other restrictions limit satellite and cellular telephones since the latter do not have models tested for reliable operation in the extreme weather conditions in which NLH employees must work. Cellular coverage is limited (i.e. on interior water reservoirs, associated dams and spillways, and on transmission lines which span the wilderness interior of the Island and Labrador, including lines running up the Great Northern Peninsula).

With radio coverage, and access, being the most important parameters of any MRS, the following summarizes NLH future MRS requirements:

1. The need for replacement of the existing mobile switch in Gander is critical. Parts are not available due the manufacturer being out of business since 1992. Trouble reports from maintenance provider Aliant are inconclusive as to cause of the card problems. Aliant is in conflict of interest to provide independent assessment to NLH Switch evaluation, a Catch 22 relationship exists between Aliant and NLH. To replace the existing MRS, is an **immediate** requirement substantiated by maintenance statistics. Aliant (a potential supplier of a new MRS) should not be in a position of providing technical advice, nor in a position of maintenance, on a new switch on which they can profit from through replacement, and further maintenance contracts.

2. The need for expanded radio coverage is identified by field personnel. Areas of coverage improvement are: The Northern Peninsula, South Coast of Labrador, the Avalon, Connaigre, and Burin Peninsulas, and various other areas specified throughout the Island.

3. Users have identified that tasks requiring the MRS occur in all weather conditions; this requirements eliminates cellular and satellite phones as viable primary alternative technologies because the phones are not designed for harsh environments. Cell, and satellite, phone are acceptable as a backup for regular operations to supplement MRS communications needs, since they can be used inside vehicles. In addition, use of satellite and cell phones would not be a direct, dedicated link (i.e. dialing, third party call routing, and ringing delays, would be introduced into the link, even if the ECC Dispatch had a dedicated emergency telephone set, and associated telephone number to call for assistance).

4. There is a need for NLH to become more independent of third party site rentals and backhaul facilities due to rapidly increasing costs of these services. Voice over Internet Protocol (VoIP) on a dedicated network, or WAN, may reduce backhaul costs but off-the-shelf radio systems, integrating VoIP interface, are only recently being introduced, but may be competitively available in late 2004. There are areas where only Aliant has the necessary sites to provide the third party tower, power, and building facilities for the NLH MRS – refer to **Table 1. Newfoundland Hydro VHF Repeater Sites** for Aliant and NLH site listing**.**

2. Background

Newfoundland & Labrador Hydro (NLH) has used the existing single switch VHF MRS configuration since 1990. This configuration has served the remote communications needs efficiently since inception. Unreliability, due primarily to aging components, lack of manufacturer parts support, and lack of technical support, has placed NLH communications in jeopardy. MRS failures has i) increased risk to workers who require availability of MRS to meet current Workplace Health and Safety Compensation Commission requirements of telecommunications access in remote workplaces, ii) created significant delays in establishment of power connections, since coordination with ECC is a necessary function of which the MRS is the only link with first line workers in many situations, and iii) affected performance of field work.

3. Need for Mobile Radio

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Voice Communications

NLH MRS is the primary facility of voice communications in field operations.

Since the MRS is currently only used by NLH and shared with Works, Services and Transportation, there are no other agencies competing for the NLH MRS in times of emergency when alternate mobile communications facilities become busy (i.e. cell phone facilities shared by the public, news media, etc). Voice traffic activity for each existing NLH site has been monitored in terms of PEG Counts – refer to **Appendix B – PEG Counts 2003 November**, which shows total MRS usage encountered 63 switch traffic blockages during 2003 November month out of a total of 162399 connections, or radio push-to-talk (PTTs) transmissions (i.e. during the year monthly PEG Count data has shown that the majority of NLH work is construction during the summer, with WST snowplowing being the primary Winter voice traffic). PEG counts indicate that the mobile user has pressed the PTT to seize the repeater at the indicated hour of day and date shown. The total usage time for user equipment is also shown, and blockage, if any, is also recorded for each radio PTT recorded at the MRS site. There is a separate PEG count record for Repeater/Switch trunks; the total PEG count is the sum of both radio, and repeater/switch records.

If NPI's MRS requirements are added to existing NLH MRS requirements, it is diligent to have a second (trunked) repeater where NLH and NPI, shared the same site. The latter configuration provides for a redundant repeater for shared users under the scenarios i) if one repeater failed, or ii) at times of local area emergencies when higher voice activity would occur, thereby improving MRS access through 2 repeater trunked operation. In addition, with 2 repeaters, a severed backhaul link, would not pre-empt local communications between 2 mobiles/portables, using the repeater, in the affected repeaters' coverage area.

The MRS provides the primary method for mobile voice communications within NLH.

Future Mobile Applications

A need has been identified by NLH for low speed data applications which can be added to the MRS, or provided as a separate wireless data network if/when suitable wireless data facilities are available from a third party, or otherwise become feasible (again, coverage, and access, will be the significant parameters, along with costs vs. benefits).

In other jurisdictions, the trend is to have data requirements served on a separate data network, However, due to the remote nature of NLH operations, any low speed data operation, which typically would not interfere with voice activity,

could be implemented on the MRS with provision being made with user equipment connections (i.e. RS232 com port) at the outset of acquisition of a new MRS.

4. Overview of Present Radio System

The existing NLH MRS is shown in Figure 3. – Present Radio System Block Diagram. The Gander Switch is of 1988 vintage and has served well beyond its expected service life.

Existing Island radio coverage is shown in Figure 1. Labrador coverage is required between the Southeast Coast extending North to Mary's Harbour. Labrador coverage is also required along the TLs in each of Happy Valley/Goose Bay and Labrador City/Wabush.

Even with the extensive Island coverage there are areas identified for improvement such as Cat Arm, St. Anthony/Roddickton on the Northern Peninsula, also including Southern Labrador, the Avalon, Burin, and Connaigre Peninsulas, South Brook TS, Bay d'Espoir & Burgeo Highways, Springdale, Glenwood, Cook's Hr., Sop's Arm, Howley, and Fogo. The need for continuous coverage of the TCH for the mobile work force has been identified. Response to a MRS Survey revealed that 73 - 82% of respondents identified improved coverage as a necessity. It is anticipated that use of the new microwave sites for repeater relocation would improve some of these problem coverage areas; and typically, with the nature of radio propagation, some relocations will create different problem areas. In general, a net improvement should occur – refer to **Appendix "E" – NLH Site Requirements (includes Labrador)**.

The existing MRS consists of a central digital switch in Gander which is connected to each repeater site via backhaul facilities which are provided by Aliant.

Operation of the existing MRS is analogous to a PBX with capabilities of interfacing any analog terminal whether it is a mobile radio, or the Public Switched Telephone Network (PSTN). Selective calling, as well as conference calling between sites, and mobiles at sites, can be set up.

User equipment is equipped with DTMF pads which allow the radio user access control of the various functions of the MRS via the switch. Trunks connecting the repeaters to the switch utilize standard 4-W E & M signaling.

There is a single repeater in the NLH MRS associated with single controller at each site, (1 controller is required for each repeater added, similar to newer MRS networks), additional generic repeaters can be added to sites for operation in trunked mode. The controller functions include validation of user equipment

access using CTCSS (sub audible tones). Although the NLH MRS is capable of failsafe operation (i.e transfer to a second repeater), this feature is not used because only a single repeater exists. The controller also provides PSTN access from any site, digital to analog (D/A) or analog to digital (A/D) conversion, and data interface to 'talk to' the central switch in Gander.

There also an existing MSR 2000 paging transmitter at each site equipped for transmitter mode only. Because of difficulty in obtaining parts, the MSR 2000 paging transmitter is no longer used for paging.

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The Switch provides the necessary data transfers to perform system management of the network including traffic measurement applications to tabulate date/time logged repeater site activity, including blockages of any port.

It is not diligent to obtain older modules as replacement for old radios since one of the critical components in modules (i.e. electrolytic capacitors) have a shelf life which lessens when stored without power applied.
Alarms are also an integral part of the MRS system management. Alarms included are:

- Status of all ports and circuits
- Master CPU fail alarm
- Length of call timer
- Loss of communications with the repeater sites.

An existing printer, located in Gander, continuously prints the maintenance alarm activity. The new MRS system shall have similar alarm reporting except to St. John's, and Deer Lake.

Various call restrictions can be programmed into the MRS. CRTC requirements for the new MRS limits PSTN calling to the Provinces area 709 number plan only.

Unlike the many proprietary trunked networks available today, the existing MRS provides for interconnect of most generic repeater equipment, and thereby provides for acquisition of multi sourced user mobile equipment equipped with a DTMF microphone, or pad.

The existing MRS is shared by NLH and the Department of Works, Services, and Transportation. NLH retains the option to exercise priority for emergency radio access to repeaters. Priority is exercised by NLH interrupting a WST radio user and requesting that the channel be freed. There have been only a few incidents of radio use conflicts which have been resolved through training of users. The existing system works well as a shared MRS.

The existing NLH MRS provides the following types of call scenarios to users:

1. Local calls using simplex channels (without repeater activation).
2. Local calls using the repeater duplex channel pair.
3. Calls to the Energy Control Center (ECC) at Hydro Place.
4. Emergency calls (911) to the ECC.
5. Point to point calls between repeater coverage areas.
6. Conference calls amongst users.

The most critical MRS application is when a mobile user communicates with ECC to coordinate power line work (i.e. when to energize power lines).

TABLE 1- NLH Sites
- new/upgraded microwave sites shown in 'bold' font – see Appendix E for Labrador-

Site Name	Latitude, N	Longitude, W	Elevation, m ams	Site Owner
Annieopsquotch	48 15 05	57 43 26	558	Aliant
Bay d'Espoir Hill	47 59 42	55 46 5	262	NLH
Bay l'Argent	47 32 11	54 51 34	244	Aliant
Blue Grass Hill	49 03 31	57 11 13	434	NLH
Blue Mountain	51 29 31	55 45 58	55	NLH
Bonne Bay	49 22 10	57 44 16	480	Aliant
Brent's Cove	49 54 37	55 40 23	198	Aliant
Bull Arm Hill	**47 49 45**	**53 56 19**	**145**	**NLH**
Carmanville	49 25 13	54 17 27	89	Aliant
Chapel Arm Hill	**47 30 38**	**53 43 22**	**224**	**NLH**
Clarenville	48 11 21	54 02 17	290	Aliant
Codroy	48 03 31	58 51 27	389	Aliant
Come by Chance	**47 48 02**	**53 59 32**	**31**	**NLH**
Corner Brook	48 55 11	57 58 15	381	Aliant
Four Mile Hill (Hawke Hills)				**NLH**
Gambo	48 49 49	54 22 04	207	Aliant
Godaleich Hill	48 15 28	56 10 00	350	NLH
Granite Canal Hill	**48 11 53**	**56 49 21**	**332**	**NLH**
Gull Pond Hill	**48 17 29**	**55 28 31**	**285**	**NLH**
Hawke Hills	47 19 19	53 07 32	290	Aliant
Hardwoods	**47 31 26**	**52 50 50**	**162**	**NLH**
Hermitage	47 33 32	55 56 21	274	Aliant
Holyrood Plant	**47 27 10**	**53 05 50**	**7.6**	**NLH**
Hydro Place (ECC)	**47 32 23**	**52 45 13**	**124**	**NLH**
Jackson's Arm	49 52 57	56 47 06	290	Aliant
Kenmount	47 32 01	52 47 27	255	Aliant
Mary March Hill	**48 49 12**	**56 43 15**	**335.4**	**NLH**
Millertown	48 48 36	56 31 45	232	Aliant
Mount Margaret	51 01 05	56 48 47	279	Aliant
Notre Dame Hill	**49 08 46**	**55 04 39**	**101**	**NLH**
Oxen Pond	**47 34 23**	**52 45 20**	**174**	**NLH**
Petty Harbour Hill	**47 30 53**	**52 44 22**	**172**	**NLH**
Port Saunders	50 38 58	57 17 51	79	Aliant
Portland Creek	50 08 41	57 37 39	172	Aliant
Red Cliff	48 57 13	55 47 43	199	Aliant
Red Rocks	47 40 35	59 18 10	197	Aliant
Rocky Ridge	47 51 20	57 39 08	488	Aliant
Sandy Brook Hill	**48 52 36**	**55 47 24**	**283**	**NLH**
Serrated Hills	47 40 26	53 51 48	213	Aliant
Sheffield	49 21 42	56 33 24	468	Aliant
Shoal Harbour Hill	**48 11 28**	**54 02 24**	**282**	**NLH**
Southwest Brook	51 01 14	56 08 47	92	Aliant
St. Anthony	51 20 56	55 36 36	132	Aliant
Stephenville	48 31 38	58 29 13	130	Aliant
Square Pond Hill	**48 49 46**	**54 21 52**	**207**	**NLH**
Sunnyside	**47 51 02**	**53 57 06**	**60**	**NLH**
Western Avalon	**47 31 01**	**53 41 03**	**64**	**NLH**
Western Avalon Passive	**47 31 08**	**53 41 12**	**120**	**NLH**

Existing NLH user equipment consists of the following radio models:

Mobiles/base stations:

Motorola MCX 1000
Motorola MCS 2000

Portables:

Motorola MT1000
Motorola HT 1250
Motorola GP 300
Motorola GP 350

The MRS is supplemented by cellular and satellite phones for special requirements via an internal “Request for Communications Service” Form. The reader is referred to Appendix “D” - Radio Service Manual reprinted April 2000, for detailed information on call setup, and number plans, service tones, and frequency plans used in the existing MRS.

5 Present Plans

The immediate plan is for replacement of the existing switch as the failure rate is increasing exponentially. Depending on the final technology chosen, and how the repeater controller interacts with the switch and user equipment, repeater replacement may be phased-in, or replaced simultaneously with the new Switch.

User equipment requires replacement since many radios are manufacturer discontinued and suffer lack of replacement parts availability. It is diligent to replace any equipment which is manufacturer discontinued (M/D’ed), or at least have a short timeframe replacement plan, with funding in place to actively retire any M/D’ed equipment in NLH’s mobile work force.

It is planned to retain the functionality of the existing system, with some limited features, such as roaming, as its design meets the operational requirements of NLH, with the exception that greater coverage is required to supplement the existing NLH MRS functionality. Roaming increases the apparent coverage area since a MRS roam feature automatically seeks the best signal level of adjacent repeaters, as opposed to a user having to manually switch several times in fringe, or coverage crossover areas of operation.

It is also recognized that shared MRS usage provides mutual benefits through infrastructure sharing. It is anticipated that the initial capital and annual expenses will be shared. This arrangement also keeps utility customer rates down as a result.

Due to the significant costs, and recent increases, of co-siting with Aliant and incurring backhaul, tower & building space, and standby power costs; it is NLH's objective to utilize as many new NLH microwave sites for relocation of repeaters. It is recognized that NLH has sites which can be shared with NPI, and vice versa, and it would be diligent for coverage predictions be completed with the objective of reduced dependence on third party facilities, thereby providing an element of annual, and associated increasing costs to be minimized, or at least stabilized by use of mutually shared MRS facilities.

An option to reduce backhaul costs would be to utilize VoIP. The writer is aware of some work in progress by NPI/Aliant to improve backhaul using VoIP. Some new MRS technologies have VoIP connectivity, but the application of routers in the immediate future, for replacing MRS switch is questionable and falls within the realm of R & D. Since technology does change rapidly, when a tender for MRS replacement is called there may be VoIP solutions available, or proposed, as the writer is aware of at least one supplier claiming to have VoIP connectivity with the mature MPT 1327 1980s technology.

NLH does not want to replace the existing integrated MRS with technologies which are assembled as a piecemeal system utilizing equipment from various suppliers. Even with factory testing before shipping, integration problems are experienced when systems of different manufacturers are integrated to implement a mobile radio system. To reduce integration problems, integrated systems of a single manufacturer, should be acquired.

6. Future MRS Requirements

Assumptions

1. Newfoundland Power Inc. will supply, own, and maintain the core MRS infrastructure. Newfoundland Hydro will own and maintain its own user equipment.
2. Newfoundland Power will administer all radio frequency licenses for the new radio system, except simplex frequencies that will be assigned exclusively for Newfoundland Hydro's local communications.
3. Newfoundland Hydro will co-operate in a joint sharing arrangement in accordance with Industry Canada, and CRTC Policy, in order to implement joint use MRS operation. This arrangement will include accepting toll restricting access to within the Province of Newfoundland and Labrador in accordance with CRTC requirements.
4. Newfoundland and Labrador Hydro's ownership and responsibility will be limited to only user equipment, being radios which are accepted by Newfoundland Power for operation on their MRS.
5. NLH will provide access to the NLH microwave facilities for MRS backhaul use only, and at established rates; uses such as WAN data and SCADA is beyond the scope of this Report.

6. NLH will provide access to NPI in accordance with a Terms of Reference, for use by other than NPI MRS circuit requirements (i.e. SCADA and administration circuits), on a basis to be mutually agreed, by all parties.
7. NLH will provide access to the NLH microwave sites by third parties who need to access the microwave sites for maintenance of the MRS only, and in accordance with a mutually agreed Terms of Reference.

General Requirements

1. Radio Coverage shall be all of NLH's currently serviced areas as shown in Figure 1, and shall provide for the addition of additional sites which are identified in Appendix E. Provision shall also be made to facilitate increasing NLH MRS coverage through future expansion by adding repeater, or local base station, sites.
2. The MRS shall be functionally equivalent to the present system, with the addition of features which are to be included in a Feature Matrix which is presently being completed as part of a Study including NPV Cost Analysis, as required by PUB Order 29 (2003).
3. The MRS shall have switching redundancy (either distributed, or separated into a minimum of 2 - East & West - Island partitions).
4. Battery backup power at each repeater site of 36 hours minimum per IEEE Standards and generator backup following depletion of batteries as implemented at the NLH microwave sites..
5. The MRS shall have system management functions available to NLH operations (separate PC connections per NLH requirements) in order to ensure a minimum Grade of Service of 5% in both regular, and emergency operations (i.e. only 5 calls out of 100 shall be blocked).
6. Any new repeater, or user equipment, shall be Industry Canada type approved in the existing NLH VHF band and capable of 12.5kHz/25kHz bandwidth operation to provide for ease of future VHF expansion in the congested spectrum usage areas. New radios shall be capable of dual bandwidth programming.
7. Repeaters shall be considered for redundancy at sites determined by mutual NLH/NPI agreement, in order to achieve the 5% GoS, above.
8. Provision for voice encryption on selected radios shall be considered to meet field users who are involved in NLH operations requiring privacy (i.e. communications with ECC involving decisions to ration power during emergency situations). The objective is to prevent readily available scanners to permit eavesdropping on NLH personnel.
9. The MRS shall have an alarm system which electronically reports major and minor site alarms to the NLH ECC, with an option to add the Deer Lake Office for monitoring.
10. Telephone (PSTN) interfacing will be required at NLH selected repeater locations, and will require toll restriction interface to restrict long distance calling outside the Province; and other numbers as required by NLH.

11. User equipment shall require repeater validation ID specific to individual radio identification for asset tracking. Busy lockout, or Tx inhibit feature shall be available.
12. A redundant switch configuration is required. This switch shall one partition on the Avalon and at least one partition located off the Avalon Peninsula. A distributed switch function is acceptable.
13. Call progress indication shall be used to indicate to the radio user the status of his call (i.e. repeater busy, repeater available callback, or queued, remote repeater busy on a selective call).
14. User equipment shall be available from multiple manufacturers (3 minimum) and local suppliers with service capability in 3 major centers St. John's, Grand Falls, and Corner Brook. Radio functionality shall be consistent between models to minimize user confusion when spares are exchanged for replacement (i.e. minimize retraining based on model differences).
15. User equipment shall be available in MIL 810 Standard approved for driven rain, dust, shock, and temperature ranges acceptable to NLH for their operational area requirements.
16. The MRS provided for use by NLH shall provide for the ECC, or any other radio, locating a specific user radio who is in an unknown area; this may be accomplished by multiple repeater keying.
17. A time out timer on the repeater, or message trunking, shall be provided to permit a completed 2 way call prior to repeater access by another mobile.
18. System software (i.e. alarms) interface to NLH shall utilize a standard MS Windows^{SM} operating system such that consoles are readily available for replacement of failed consoles. An MS XP, or latest, upgrade path shall be provided for the service life of the MRS.
19 The MRS shall identify the option to support the capability of user equipment to provide low speed data (i.e.1200 bps minimum).
20. User equipment for the MRS shall have models available with data capability.
21. Selective calling may be made between user equipment using standard DTMF interface.
22. Priority repeater access shall be equal to NPI.
23. Provide for optional priority access with compatible user equipment with priority call features (i.e. emergency button).
24. User equipment shall be clone capable for ease of reprogramming, and flash programmable for ease of software upgrading from a standard MS Windows^{SM} operating system; the MS XP^{SM} software, or latest upgrade path, is to be provided for MRS applications software.
25. User equipment models shall be available with alpha-numeric displays, and with remote heads for installation in vehicles having limited passenger space.
26. The MRS switch shall have capacity to increase the number of sites/repeaters to allow for coverage growth needs beyond Appendix E, and current NLH site requirements. Provision shall be made independently

to add future NPI site expansion in addition to future NLH expansion requirements.

27. The MRS shall provide for a transition between conventional user equipment, and new user equipment, if the new requires special protocol features with the switch, repeater controller, and switch.
28. Repeater sites shall be fail safe (i.e. reverting to conventional repeater mode using carrier operated squelch) in the event of a link failure with the central switch. This mode shall also send an alarm to the NLH ECC.
29. A Life Cycle Plan shall be provided which demonstrates software, and/or hardware, upgrades to ensure a minimum ten (10) year life of the asset investment in all MRS equipment.

Coverage Area

1. Coverage, required by NLH, is identified, and discussed in concert with NPI, and summarized in Appendix "E".

Radio (also "Terminal", or "User") Equipment

1. Existing NLH radio equipment is as follows - **refer to Appendix "D" NLH Radio Services Manual**:

Type	**Quantity** (approx.)
Mobiles	325
Portables	100
Base Stations	60

2. In addition to the MRS repeater channels, NLH will continue to use the simplex channels for direct, short range radio-to-radio communication.

3. RF channel bandwidth is 25 kHZ existing but newer radios will be capable of 12.5 Khz to allow for Industry Canada Policy for future ease of VHF frequency acquisition in congested areas.

System Usage

1. Appendix B shows the total radio, repeater and switch traffic activity for the month of 2003 November, during which time emergency conditions did not exist, the traffic would be much higher during emergency situations.

2. NLH average usage of the MRS is not expected to exceed the following:
a. Normal Conditions:

i. Repeater traffic : refer to Appendix B

b. Emergency conditions: NLH to have equal MRS priority access as does NPI.

3. NLH will accept sharing of a single repeater at a site, provided the voice traffic of NPI cannot be heard, and that NLH's required Grade of Service is met.

ECC Console - refer to the NLH Radio Services Manual (Manual) for calling patterns:

1. The ECC shall be provided with a redundant ECC Console.

   Further calling patterns for ECC Console calling are described in Appendix D - Manual.

Operational Features

1. NLH preference is for the MRS operation to be similar to the existing MRS including the existing feature of accessing a radio user who is in the coverage area of an unknown repeater. Automatic roaming optimizes the effective coverage by enabling user equipment to automatically select the best repeater, at transition areas, thereby increasing virtual coverage; however, simultaneous keying of all repeaters is an acceptable way to accomplish this requirement.

2. Other acceptable variations to NLH existing MRS may be proposed by NPI if NPI provisions the final MRS; these differences shall not cause the new MRS to be less 'user friendly' for NLH users. Any variations in technical operation shall require mutually agreement.

Appendix B

Date: 02/03/98 Circuit Usage Summary Page 1
Start: **01-NOV-2003 at 00:00:00** **End: 30-NOV-2003 at 23:59:59**

Radio / Repeater + Switch

Site	TOTAL PEG COUNT	TOTAL USAGE TIME	TOTAL **BLOCKAGE** COUNT
Central Switch	0162399	227:55:17	**000063**
Kenmount Hill	0005911	019:26:25	000000
Hawke Hills	0005969	008:55:41	000000
Serrated Hills	0005947	008:46:43	000000
Bay L'Argent	0006721	017:25:04	000000
Clarenville	0006880	020:47:29	000000
Gambo	0006157	010:46:11	000000
Red Cliff	0000000	000:00:00	000000
Sheffield	0006463	016:46:07	000000
Brents Cove	0006402	015:39:20	000000
Jackson Arm	0006000	011:19:32	000000
Carmanville	0006128	011:37:23	000000
Hermitage	0006099	011:33:16	000000
Bay D'Espoir Hill	0006759	020:41:05	000000
Godaleich Hill	0005946	008:53:35	000000
Millertown	0005861	007:43:44	000000
Red Rocks	0006388	013:36:11	000000
Codroy	0006020	009:34:30	000000
Stephenville	0007387	029:55:08	000000
Corner Brook	0007965	025:53:44	000000
Blue Grass Hill	0006090	010:35:53	000000
Annieopsquotch	0006449	021:20:23	000000
Rocky Ridge	0006773	027:00:24	000000
St. Anthony	0006684	021:59:59	000000
Southwest Brook	0006140	013:15:20	000000
Mount Margaret	0006898	027:32:14	000000
Port Saunders	0007604	023:05:57	000000
Portland Creek	0006116	018:01:33	000000
Bonne Bay	0007300	031:57:42	000000
Gander (Actv Spare)	0000000	000:00:00	000000

Nfld & Lab Hydro Existing Repeater Sites (New/upgraded microwave Sites shown in **bold**)

APPENDIX C

File:ExistingSite.NewuWa

Site Name	Latitude (N)	Longitude (W)	Elevation (m AMSL)	Owner	Tower Ht. (m)	ERP (W)	TX Freq	RX Freq	Rev 04 03 07 - 00 Notes
Annieopsquotch	48 15 05	57 43 26	558	Aliant	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	Aliant	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	Aliant	40	105	163.86	170.22	Three Tom
Brent's Cove	49 54 37	55 40 23	198	Aliant	50	102	164.22	170.28	formerly Baie Verte.
Bull Arm Hill	**47 49 45**	**53 56 19**	**145**	**NLH**	**91**				**BAH**
Burnt Hill	48 08 20	57 22 08	410	NLH	75				BTH
Carmanville	49 25 13	54 17 27	89	Aliant	45	105	163.23	170.49	
Chapel Arm Hill	**47 30 38**	**53 43 22**	**224**	**NLH**	**82**				**CAH**
Clarenville	48 11 21	54 02 17	290	Aliant	88	93.3	162.75	170.34	Shoal Hr.
Codroy	48 03 31	58 51 27	389	Aliant	31	110	163.08	172.29	
Come by Chance	**47 48 02**	**53 59 32**	**31**	**NLH**					**Spur Site**
Corner Brook	48 55 11	57 58 15	381	Aliant	71	60.3	172.53	167.43	
Four Mile Hill				**NLH**					**same site as Hawke**
Gambo	48 49 49	54 22 04	207	Aliant	43	102	163.08	172.29	
Godaleich Hill	48 15 28	56 10 00	350	NLH	48	15	163.23	170.49	
Granite Canal Hill	**48 11 53**	**56 49 21**	**332**	**NLH**	**94**				**GCH**
Gull Pond Hill	**48 17 29**	**55 28 31**	**285**	**NLH**	**84**				**GPH**
Hawke Hills	47 19 19	53 07 32	290	Aliant	29	102	163.08	172.29	FMH
Hardwoods	**47 31 26**	**52 50 50**	**162**	**NLH**					
Hermitage	47 33 32	55 56 21	274	Aliant	25	112	163.86	170.22	
Holyrood Plant	**47 27 10**	**53 05 50**	**7.6**	**NLH**					**Spur Site**
Hydro Place (ECC)	**47 32 23**	**52 45 13**	**124**	**NLH**					
Jackson's Arm	49 52 57	56 47 06	290	Aliant	13	117	163.62	170.01	
Kenmount	47 32 01	52 47 27	255	Aliant	20	74.1	172.53	167.43	Ht. Approx
Mary March Hill	**48 49 12**	**56 43 15**	**335.4**	**NLH**	**116**				replaces Millertown
Millertown	48 48 36	56 31 45	232	Aliant	96	87.1	163.86	170.22	
Mount Margaret	51 01 05	56 48 47	279	Aliant	60	105	162.75	170.34	
Notre Dame Hill	**49 08 46**	**55 04 39**	**100.5**	**NLH**	**122**				
Oxen Pond	**47 34 23**	**52 45 20**	**174**	**NLH**					
Petty Harbour Hill	**47 30 53**	**52 44 22**	**172**	**NLH**					**replaces Kenmount**
Port Saunders	50 38 58	57 17 51	79	Aliant	124	102	162.63	170.19	
Portland Creek	50 08 41	57 37 39	172	Aliant	20	115	164.79	170.52	
Red Cliff	48 57 13	55 47 43	199	Aliant	137	70.8	164.79	170.52	
Red Rocks	47 40 35	59 18 10	197	Aliant	71	95.5	163.62	170.01	
Rocky Ridge	47 51 20	57 39 08	488	Aliant	21	29.5	163.62	170.01	
Sandy Brook TS	**48 52 36**	**55 47 24**	**283**	**NLH**	**94**				**replaces Red Cliff**
Serrated Hills	47 40 26	53 51 48	213	Aliant	46	10	163.62	170.01	
Sheffield	49 21 42	56 33 24	468	Aliant	94	89.1	162.75	170.34	
Shoal Harbour Hill	**48 11 28**	**54 02 24**	**282**	**NLH**	**98**				**to Replace Cl'ville**
Southwest Brook	51 01 14	56 08 47	92	Aliant	65	95.5	163.62	170.01	
St. Anthony	51 20 56	55 36 36	132	Aliant	46	112	163.86	170.22	
Stephenville	48 31 38	58 29 13	130	Aliant	36	105	164.79	170.52	
Square Pond Hill	**48 49 46**	**54 21 52**	**207**	**NLH**	**102**				**repl Jonathan Rptr?**
Sunnyside	**47 51 02**	**53 57 06**	**60**	**NLH**					
Western Avalon	**47 31 01**	**53 41 03**	**64**	**NLH**					**Spur link**
Western Avalon Passive	**47 31 08**	**53 41 12**	**120**	**NLH**	**20**				**Spur link**

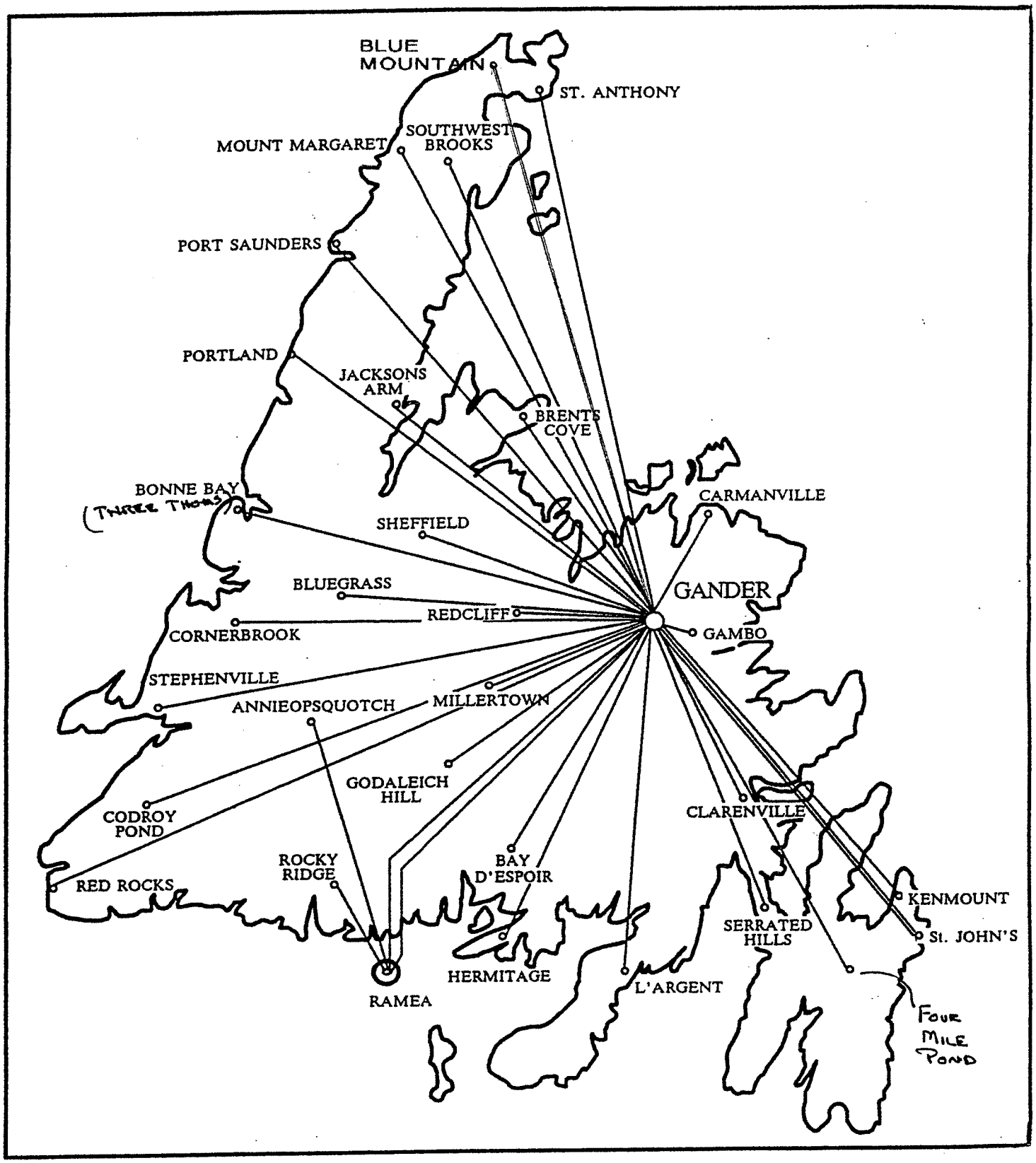


FIGURE 1.8 NEWFOUNDLAND SITE LOCATIONS

APPENDIX D

NLH Radio User's Manual

(not included)

APPENDIX E

RADIO SITE SELECTION FOR NEWFOUNDLAND & LABRADOR HYDRO'S VHF RADIO REQUIREMENTS

2004 March 06

The following Sites are selected for VHF coverage in the newly proposed Mobile Radio System (MRS) for NLH. Sites are reviewed beginning on the Avalon Peninsula and moving westerly to include Labrador. MRS coverage used for site selection is based on the VHF Predict Software having a mutually agreed set of transmission parameters as existing NPI sites for coverage comparison, and supplemented by input from field radio users. **The format is equivalent to the NPI site summary in order retain some standard of comparison**:

The information below references existing sites for replacement; Aliant sites are replaced with NPI sites, or new NLH microwave sites wherever feasible, to maximize existing NLH backhaul facilities (i.e. existing microwave capacity). Aliant sites are backhauled on Aliant facilities; new NLH sites will use NLH microwave backhaul facilities having ample bandwidth capacity for NLH and NPI MRS requirements.

1. **Petty Harbour Hill** (NLH)

a. Site facilities owned by NLH.
b. Powered by 36 hour battery backup and standby generator.
c. This is a new microwave site.
d. Linked to ECC via NLH microwave.
e. This site can replace the existing Kenmount Hill Aliant Site.
f. NPI adjacent Torbayman's Pond can be utilized in place of this site, if building space is available.

NPI Disposition: ***Not required by NPI.***

2. **Oxen Pond Terminal Station** (NLH)

a. Site facilites owned by NLH.
b. Powered by 36 hour battery backup and standby generator.
c. This is a new microwave site.
d. Linked to ECC via NLH microwave.
e. This site is not required for NLH MRS as Petty Harbour Hill provides adequate coverage of St. John's and area TLs 218, & 236.

NPI Disposition: ***Not required by NPI.***

3. Four Mile Hill (NLH)

a. This new microwave site is required for NLH MRS to bridge radio coverage between Petty Harbour Hill and Chapel Arm Hill for TCH coverage.
b. Powered by 36 hour battery backup and standby generator.
c. If NPI Torbayman's Pond is feasible, and available to NLH, pending building space and power backup capacity, this site will not be required by NLH for MRS.
d. All facilities, including backhaul to the ECC, are available.

NPI Disposition: Not required by NPI or NLH.

4. Chapel Arm Hill (NLH)

a. Site is owned by NLH. Tower, battery, and space exists.
b. Powered by 36 hour battery backup and standby generator.
c. This site is required to provide MRS coverage on the Isthmus; a critical location for TL failure due to the higher probability of icing.
d. Adequate mux facilities exist for MRS requirements.
e. 1 MRS channel will be adequate due to the proximity of Bull Arm Hill, the site immediately West.

NPI Disposition: This site can replace Whitbourne if linking is feasible to their Peter's River and Placentia sites. A link to the NPI Placentia site is confirmed. Peter's River requires a pt-pt path review, or rented line.

5. Bull Arm Hill (NLH)

a. Site is owned by NLH. Tower, battery, and space exists.
b. Powered by 36 hour battery backup and standby generator.
c. This site supplements Chapel Arm Hill in MRS coverage of the Isthmus, a critical TL failure point due to icing.
d. Provides TCH coverage into Terra Nova Park and provide good coverage to the Northern area of the Burin Peninsula Highway, as required by NLH radio users.
e. Covers the Northern portion of the Burin including TLs 202, 206, 212, & 219.
f. 2 VHF repeaters are required at this site due to voice traffic potential in emergency conditions.

NPI Disposition: NPI is interested in sharing this Site and linking with Clarenville and Lockston Hill sites.

6. Shoal Harbour Hill (NLH)

a. This is a new NLH microwave site with adequate MRS space.
b. Powered by 36 hour battery backup and standby generator.
c. NPI exists on an adjacent site, hence can be accommodated (relocated).

NPI Disposition: ***NPI can share site***.

7. Bay L'Argent (Aliant)

a. Aliant site to be retained due to unique location for Burin Peninsula coverage.
b. 1 VHF Repeater is adequate for this area.

NPI Disposition: ***NPI is interested in sharing this site and linking to their Marystown site.***

8. Marystown

a. This is an Aliant site occupied by NPI.
b. NLH will improve Burin Peninsula South of the Bay L'Argent site pending service location needs, TLs 212 & 219 (i.e. to Salt Pond TS).
c. There is coverage potential across St. Mary's Bay for supplementary coverage for Hermitage (i.e. English Harbour West).

NPI Disposition: ***NPI will continue use of site.***

9. Square Pond Hill

a. This is a new microwave site with ample MRS space facilities.
b. Powered by 36 hour battery backup and standby generator.
c. This site supplements the Carmanville Aliant site for coverage of the Gander Bay Road, with a small section, estimated 10 km, falling below a predicted 90% (time,location) mobile talkback coverage.
d. Joins with NLH's new microwave sites Shoal Harbour Hill (Clarenville) and Notre Dame Hill for TCH coverage.

NPI Disposition: ***Potential site for replacing Aliant Jonathan Site on Gander Bay Road, when used with Carmanville.***

10. Carmanville (Aliant) – rented by NLH.

a. This site to be retained by NLH for coverage on Gander Bay Road and Fogo Island (i.e. TL 254).

NPI Disposition: ***Will consider this site, with Square Pond Hill Hydro site as a potential replacement for Jonathan's Aliant site.***

11. Notre Dame Hill (NLH)

a. This is a new NLH microwave site.
b. Powered by 36 hour battery backup and standby generator.
c. Provide TCH coverage between adjacent newly developed NLH microwave sites Square Pond Hill (East) and Sandy Brook Hill (West)
d. Provides coverage of TL Grand Falls and Gander section.

NPI Disposition: Will replace Rattling Brook site.

12. Sandy Brook Hill (NLH)

a. This is an existing upgraded NLH microwave site.
b. Powered by 36 hour battery backup and standby generator.
c. This site replaces the existing Red Cliff MRS site owned by Aliant.
d. Supplements Notre Dame Hill coverage on TCH.
e. Provides coverage on TLs 210, 205, 232, 204, & 231.
f. Space needs to be reviewed for MRS accommodation of redundant repeaters.

NPI Disposition: Replaces NPI own Sandy Brook adjacent site and provides improved coverage to NPI.

13. Gull Pond Hill (NLH)

a. This is an existing NLH site upgraded for microwave radio, necessary for coverage of the Bay d'Espoir Highway and TL between BDE and the Isthmus, TLs 204 & 231.
b. Powered by 36 hour battery backup and standby generator.
c. MRS space and battery backup requirements need review.

NPI Disposition: Not required by NPI.

14. Hermitage (Aliant)

a. This is an existing Aliant site rented by NLH for coverage on the tip of the Connaigre Peninsula.
b. NLH to retain this site.

NPI Disposition: Not required by NPI.

15. Sheffield Lake (Aliant)

a. This is an Aliant site currently used by both NLH and NPI.
b. The site will be retained due to its strategic TCH coverage.
c. Potential exists for sharing of a single repeater by both utilities pending traffic estimates under emergency conditions.

NPI Disposition: ***Retention of site; potential review for sharing with NLH (NLH only, without WST, and pending traffic review? – it is understood, based on discussion, that if NLH is the MRS supplier WST will be included in all traffic review estimates; if NPI is owner, WST traffic will not be considered). This issue arises at existing NLH/NPI joint use sites such as Corner Brook, etc.***

16. Mary March Hill (NLH)

a. This is an existing NLH microwave site upgraded to accommodate the new NLH microwave system.
b. Powered by 36 hour battery backup and standby generator.
c. This will replace the existing Aliant Millertown site to cover TLs 205, 232, 228, & 233.

NPI Disposition: ***NPI sees some benefit to sharing this site with NLH.***

17. Annieopsquotch (Aliant)

a. This site is rented by NLH from Aliant.
b. The strategic location of this site for Burgeo Highway, and TLs 250 & 233, coverage requires it retention by NLH.

NPI Disposition: ***NPI does not require this site.***

18. Rocky Ridge (Aliant)

a. This site is rented by NLH from Aliant.
b. The site covers all of the TL 250 running to Grandy Brook and West TL 255.
c. The potential of replacing this site with existing Burnt Hill depends on actual radio coverage tests being made towards the TL running West of Grandy Brook. PC prediction indicates less than 90% (time, location) availability for mobile talkback; it is not recommended for portable talkback reliability. Burnt Hill Site would require significant reconstruction if sued for MRS.

NPI Disposition: ***NPI does not require Rocky Ridge.***

19. Granite Canal (NLH)

a. This is a new NLH microwave site.
b. Powered by 36 hour battery backup and standby generator.
c. This site will improve coverage over the reservoir area.

NPI Disposition: ***Not required.***

20. Blue Grass Hill (NLH)

a. This existing microwave site is owned by NLH and upgraded to a new microwave site.
b. Powered by 36 hour battery backup and standby generator.
c. This site provides TCH coverage between Deer Lake and Corner Brook supplemented by the rented Corner Brook (Aliant) site, where NPI also rents

NPI Disposition: ***Site may replace NPI Deer Lake (Aliant) site, if coverage towards Wiltondale is adequate for NPI. Alternately, NLH rents a repeater location at Bonne Bay (Aliant) which could supplement Blue Grass Hill for Wiltondale area coverage.***

21. Brent's Cove (Aliant)

a. This site is owned by Aliant.
b. This site will be retained by NLH due to its strategic location.

NPI Disposition: ***Not required.***

22. Jackson's Arm (Aliant)

a. This site is owned by Aliant.
b. This site will be retained due to its strategic coverage of the road to the Cat Arm Power Plant.

NPI Disposition: ***Not required.***

23. Corner Brook (Aliant)

a. This is site owned by Aliant.
b. NPI and NLH both rent this site.

NPI Disposition: ***Potential sharing of repeater(s) pending final technology configuration.***

24. Stephenville (Aliant)

a. This site is owned by Aliant.
b. This site shall be retained pending field tests to verify if Pine Tree (NPI) site will cover the TCH to a point where Red Rocks (Aliant) site picks up radio coverage such that continuous coverage exists. Preliminary computer analysis indicates that it will be retained.

NPI Disposition: Not required.

25. Codroy (Aliant)

a. This site is owned by Aliant.
b. Pending field testing – see Stephenville above, this site shall be retained until field test outcome is known.

NPI Disposition: Not required.

26. Red Rocks (Aliant)

a. This site is owned by Aliant and rented by NLH..
b. This site is also rented by NPI.
c. Potential of sharing a single repeater pending selection of final technology and mutually agreed 5% Grade of Service pending emergency traffic review.

NPI Disposition: Required.

27. Bonne Bay (Aliant, AKA Three Tom)

a. This site is owned by Aliant.
b. Site facilities rented by NLH.
c. Retention of site required due to strategic Northern Peninsula Highway.

NPI Disposition: Not required.

28. Portland Creek (Aliant)

a. This site is owned by Aliant.
b. Site facilities rented by NLH.
c. Retention of site required due to strategic Northern Peninsula Highway.

NPI Disposition: Not required.

29. Port Saunders (Aliant)

a. This site is owned by Aliant.
b. Site facilities rented by NLH.
c. Retention of site required due to strategic Northern Peninsula Highway.

NPI Disposition: Not required.

30. Mount Margaret (Aliant)

a. This site is owned by Aliant.
b. Site facilities rented by NLH.
c. Retention of site required due to strategic Northern Peninsula Highway.

NPI Disposition: Not required.

31. Blue Mountain (NLH)

a. This site is owned by NLH.
c. This site's coverage may be supplemented by an Aliant site across the Strait of Belle Isle
c. Retention of this site is required due to strategic Northern Peninsula Highway.

NPI Disposition: Not required.

32. St. Anthony (Aliant)

a. This site is owned by Aliant.
b. Site facilities rented by NLH.
c. Retention of site required due to strategic Northern Peninsula Highway.

NPI Disposition: Not required.

33. Southwest Brook (Aliant)

a. This site is owned by Aliant.
b. Site facilities rented by NLH.
c. Retention of site required due to strategic Northern Peninsula Highway.

NPI Disposition: Not required.

34. Mary's Harbour, Labrador (Aliant)

a. This site is owned by Aliant and not yet occupied by NLH.
b. This site will improve coverage on the GNP.

NPI Disposition: Not required.

35. L'Anse au Loup, Labrador (Aliant)

a. This site is owned by Aliant and not yet occupied by NLH.
c. This site will improve coverage on the Northern Peninsula Highway.

NPI Disposition: Not required.

36. Woody Harbour, Labrador (Aliant)

a. This site is owned by Aliant and not yet occupied by NLH.
b. Site facilities rented by NLH.
c. This site will improve coverage on the Northern Peninsula Highway.

NPI Disposition: Not required.

The following sites shall be provided with the necessary options to be integrated with the Island MRS system in the future, but would be initially configured to continue operation as stand-alone.

37. Labrador City, Labrador (Aliant)

a. This site is owned by Aliant and rented by NLH.
b. Site facilities rented by NLH.
c. This site shall be provisioned for future connection to the Island MRS.

NPI Disposition: Not required.

38. Happy Valley/Goose Bay, Labrador (Aliant)

a. This site is owned by Aliant.
b. Site facilities rented by NLH.
c. This site shall be provisioned for future connection to the Island MRS

NPI Disposition: Not required.

ATTACHMENT 2b
(NPI-Option B Quote)

Newfoundland Power
VHF Mobile Radio
Requirements

Prepared for: *Newfoundland Power Inc.*
PO Box 8910
St. John's, NL, A1L 2R2

Prepared by: *Fred Hicks, P. Eng.*
Provincial Consultants Ltd.

Version: *1.3 (Final)*
Date: *February 24, 2004*

Record of Changes

Version	Purpose	Issued By	Issue Date
1.0	Review by Customer	F. Hicks	27-Jan-04
1.2	Draft	F. Hicks	30-Jan-04
1.3	Final - Appendix ‘E’ added	F. Hicks	24-Feb-04

Table of Contents

Acronyms

AT&T	American Telephone and Telegraph Company
CBC	Canadian Broadcasting Corporation
DTMF	Dual Tone Multi-Frequency
MRS	Mobile Radio System
PSTN	Public Switched Telephone Network
SCADA	Surveillance, Control and Data Acquisition
SCC	System Control Centre
VHF	Very High Frequency
WAN	Wide Area Network

1. Summary and Conclusions

The purpose of this document is to specify Newfoundland Power's technical and functional requirements for mobile radio communications so that these requirements can be incorporated into the design of a new VHF mobile radio system.

This is the first step[1] in a process ordered by the Public Utilities Board (PUB) in P.U. 29 (2003) for both Newfoundland and Labrador Hydro and Newfoundland Power to work cooperatively in researching technical options to seek the most economical means to meet the mobile communication needs for both utilities in the province of Newfoundland and Labrador.

During the course of this work, discussions were held with a number of Newfoundland Power employees (Appendix A) to assess the effectiveness of their present VHF system, to review the need for mobile radio communication, and to explore potential future applications for the system. As well, some site visits were made and documents reviewed to assess the general condition of the present system. In general, findings were as follows:

1. Newfoundland Power's present radio system adequately meets its mobile communication requirements from a functional and operational perspective.
2. For the foreseeable future, Newfoundland Power will continue to need reliable mobile radio communication throughout its service territory.
3. No additional use, other than voice communications, is anticipated for the mobile radio system.
4. Site infrastructure – i.e. towers and buildings - is in good condition and is capable of another 10 years of service life.
5. Radio repeaters and power supplies are also in good condition and are capable of another five to ten years of service, although some replacements may be necessary if spare parts for older units become unavailable.
6. Radio system usage is considerably less now than in the past because most employees also use cellular telephones. Cellular coverage though is not as good as the radio coverage and alone, cellular is not felt to be sufficiently reliable for emergency situations.

In summary, the design of Newfoundland and Labrador Hydro's planned radio system should offer to Newfoundland Power the same general functionality that its present system provides.

[1] PUB P.U. 29 (2003), Page 33 states:
"1. Newfoundland Power shall submit to Hydro a technical requirements document, including a detailed engineering assessment of the functional requirements required by Newfoundland Power for operating a mobile VHF system into the foreseeable future."

2. Background and Evolution

Newfoundland Power's requirement for a VHF radio system was driven by an increasing need for reliable mobile communications for the efficient operation of its power system, and for the safety of employees engaged in this work. The present system consisted of seven repeaters sites in 1984 and was expanded to 24 by 1998. Also, in the early 1990s, additions were made to integrate the repeater sites into a single island wide system to improve communications between the System Control Centre (SCC) in Mt. Pearl and all parts of the service territory. As a result of this evolution, the VHF radio system became the primary means of communications for Newfoundland Power personnel working or travelling in the field.

The above was the case until the late 1990s when cellular telephones became much more prevalent and are now the preferred choice for mobile communications. Cellular coverage has consequently resulted in a significant reduction in mobile radio usage. Appendix B provides a comparison of cellular calls vs. radio calls to/from the SCC during the month of November 2003. There are though some significant limitations with respect to cellular service at present:

1. Cellular coverage of Newfoundland Power's service territory is not as good as the VHF radio coverage.
2. Cellular service cannot be relied on completely during emergencies – e.g. difficult to get service when system is very busy and can fail during extended power outages.
3. It's not "friendly" for coordination of critical job tasks where workers at different places need to be aware of what others are doing.

Recently, satellite telephones have also been acquired for use in some specific locations – e.g. remote dam sites - where neither VHF radio nor cellular telephones work very well.

3. Need for Mobile Radio

Voice Communications

As stated above, although cellular telephones are being used to a greater extent in the operation of the power system, experience has shown that this service is not fully dependable 100% of the time. For example, during extreme weather conditions cellular usage by the public can increase to the point that it's difficult to obtain a cellular channel in order to place a call. It is in circumstances like this that power system troubles and outages are most likely to occur, and reliable communication is critical to effectively attend to these emergencies in a timely and safe manner.

Consequently, mobile radio communications will continued to be required for applications, including the following:

- During emergency situations – e.g. storms.
- For safety of employees and the general public when employees are engaged in hazardous tasks – e.g. working near energized power lines and equipment.
- So that employees can more efficiently coordinate specific job tasks at work sites – e.g. stringing conductors.

- To enable the SCC to closely manage critical operations being performed on the power system throughout the service territory.
- As a means of last resort when no other communication method is available.

Future Mobile Applications

At this time it is not anticipated that VHF mobile radio will be required by Newfoundland Power for applications other than voice communications.

New and emerging wireless applications – e.g. vehicle tracking, data to vehicles, etc. – are of interest to Newfoundland Power, but the current view is that it would be more cost effective to use a commercial service provider for these services.

4. Overview of Present Radio System

Newfoundland Power's service territory and present VHF radio coverage are shown in Figures 1 and 2, respectively. Functionally the radio system is divided geographically into nine *radio system areas* indicated in Figure 3. Each area, except St. John's Emergency Channel, contains from two to four repeaters connected together so that when one repeater site receives a call from a mobile, that call is re-transmitted via all the connected repeaters. In this way a call from any mobile in a *radio system area* is heard throughout that area. This is the normal or default operating mode which allows each *radio system area* to operate independently of each other so that separate calls or voice conversations can be carried on simultaneously in each area.

Figure 3 also shows a link between each *radio system area* and the SCC switch. The switch, located at the SCC in Mt. Pearl, provides additional capabilities as follows:

1. Provides connection between *radio system areas* so that mobiles in one area can talk to mobiles in another area.
2. Provides connection between the SCC consoles and each of the *radio system areas* so that an SCC Operator can call a mobile in any of the areas. Also any mobile can call in to the SCC.
3. Provides connection between the mobile radio system and Newfoundland Power's telephone system in the SCC.

Typical infrastructure at each site consists of a tower, building, power equipment with battery backup, standby generator, radio repeater with filters and antenna, and remote alarm unit.

Of the 24 sites listed in Table 1, nine are 100% owned by Newfoundland Power and 15 are owned by other organizations.

Table 1 – Newfoundland Power VHF Radio Repeater Sites

	Site Name	Site Owner	Owned by NF Power	Rented by NF Power
1	Torbayman's Pond	NF Power	All	---
2	Cape Broyle	Aliant	Radio	Tower, power, bldg, antenna
3	Hearts Content	AT&T	Radio, antenna	Tower, power, bldg
4	Whitbourne	NF Power	All	---
5	Peter's River	NF Power	All	---
6	Placentia	CBC	Radio, antenna	Tower, power, bldg
7	Lockston Hill	NF Power	Radio, antenna, pole	Power, bldg
8	Clarenville	AT&T	Radio, antenna	Tower, power, bldg
9	Marystown	Aliant	Radio, antenna, pole	Power, bldg
10	Grand Bank	NF Power	All	---
11	Lamaline	Aliant	Radio, antenna	Tower, power, bldg
12	Lumsden	Aliant	---	Tower, power, bldg, radio, antenna
13	Gambo Hill	NF Power	All	---
14	Jonathan's Pond	Aliant	Radio, bldg, antenna	Tower, land
15	Rattling Brook	NF Power	All	---
16	Sandy Brook	NF Power	All	---
17	Baie Verte	Aliant	Radio, antenna	Tower, power, bldg
18	Sheffield Lake	Aliant	Radio, antenna	Tower, power, bldg
19	Deer Lake	Aliant	Radio	Tower, power, bldg, antenna
20	Corner Brook	Aliant	Radio	Tower, power, bldg, antenna
21	Pine Tree	NF Power	All	---
22	Rose Blanche	Aliant	---	Tower, power, bldg, radio, antenna
23	Port aux Basques	CBC	Radio, bldg, antenna	Tower, land
24	Red Rocks	Aliant	Radio	Tower, power, bldg, antenna

Appendix C contains additional data - latitude, longitude, elevation, radio type, frequency assignments, etc. – specific to each site.

Appendix D describes the functionality and operation of the present system, and also indicates which of the existing features are essential or nonessential for the future.

5. Present Plans

Currently work is underway to eliminate the present switch, outlined above, and have its functionality performed by data routers that are being installed as part of Newfoundland Power's *Information Systems Network Infrastructure Project* to replace obsolete equipment in its corporate Wide Area Network (WAN). This will remove the switch as a single point of failure in the system and improve reliability. By using the WAN, the switching function will be distributed - performed by separate routers located at different locations – rather than concentrated at a single point.

All other major components – e.g. radio repeaters, power equipment, etc. – should be capable of lasting another five to ten years. In fact some of the infrastructure – towers, buildings, etc. - will be suitable for an even longer time, but age and obsolescence (unavailability of spare parts) of some electronic equipment may force the replacement of some items sooner. This should not be a problem since the radio repeaters and most other major components are of a generic design and acceptable substitutes are readily obtainable at reasonable prices.

The only other work planned for the radio system over the next five years is that for general maintenance and upkeep, including such items as:

1. Purchase of approximately 20 radios – mobiles and portables - each year as replacements for defective ones that are not economical to repair.
2. Perform routine site inspections and equipment maintenance, and perform repairs as needed.
3. Perform periodic tower inspections and upgrades to meet safety code.

6. Future Mobile Radio Requirements

This section specifies the technical and functional requirements for Newfoundland and Labrador Hydro to incorporate into the design of its planned new VHF Mobile Radio System (MRS) in order for it to meet the needs of Newfoundland Power.

Assumptions

1. Newfoundland and Labrador Hydro will supply, own and maintain all the core infrastructure comprising the MRS, including any portions – e.g. repeater sites - that may be located outside of Newfoundland and Labrador Hydro's operating territory.
2. Newfoundland and Labrador Hydro will administer all radio frequency licences for the new radio system, except frequencies that will be assigned exclusively for Newfoundland Power's use – i.e. for truck-to-truck communication.
3. Newfoundland & Labrador Hydro can acquire any of Newfoundland Power's existing radio infrastructure – e.g. sites and radio repeaters – that it would like to include in the design of the MRS.
4. Newfoundland Power's equipment ownership and responsibility will be limited to only terminal devices – i.e. radios and accessories – used by its employees.

General Requirements

1. Radio coverage shall include all of Newfoundland Power's service territory as shown in Figure 1.
2. From Newfoundland Power's perspective, the MRS shall be functionally equivalent to, and operationally similar to Newfoundland Power's present system as outlined in Section 4 and described in Appendix D.
3. The system shall be of robust design with backup power facilities to provide reliable mobile communications in severe weather conditions that can typically be expected to occur on the island of Newfoundland.

Coverage Area

1. The primary coverage objective is the service territory depicted in Figure 1. Existing radio coverage is shown in Figure 2
2. Parameters for defining the coverage area shall be as follows:
   a. Minimum receive signal strength of 1.0 μV/m.
   b. Mobile transmitter output power of 25w.
   c. Signal availability: 90% time and 90% location.
3. Coverage estimates shall include allowance for clutter (e.g. trees) as may be applicable around specific repeater sites.
4. Coverage estimates shall also be specific for the antenna pattern deployment at each site. Assume unity gain omni antenna for mobiles.
5. **Appendix 'E'** contains a selection of sites that would be satisfactory to Newfoundland Power.

Radio (Terminal) Equipment

1. User radio equipment requirements are as follows:

Type		**Quantity** (approx.)
Mobiles	(in-vehicle)	260
Portables	(handheld)	75
Base stations	(fixed)	25

2. In addition to the MRS channels, Newfoundland Power will continue to use the three channels that it currently has for truck-to-truck communication (Channels 9, 11 and 12 in Table D-4, Appendix D).
3. RF channel bandwidth shall be 25KHz

System Usage

1. Appendix B includes radio usage statistics for the month of November 2003, and is assumed to be typical of the number of radio calls to/from the SCC under normal conditions.
2. Newfoundland Power's average usage of the MRS is not expected to exceed the following:
   a. Normal conditions:
      i. Calls to/from SCC: 50 per day
      ii. Calls per repeater: 25 per day (including calls to/from SCC)
   b. Emergency conditions: Equal sharing of the air wave resources with Newfoundland and Labrador Hydro.

SCC Consoles (See Section 2, Appendix D for existing operation)

1. The SCC shall be provided with five consoles - four in the Control Room and one in the Event Management Room.
2. Consoles shall serve the dual purpose of:
   a. Terminal device for answering and originating radio calls.
   b. Telephone set for PSTN access.

3. Two numbers (currently #438 and #458) shall be assigned for calling the SCC and each shall be separately distinguishable at the consoles. Currently separate audio paths are used to deliver #438 and #458 calls to the consoles from each *radio system area* and lights (total of 20) indicate whether the incoming call is #438 or #458.
4. Additionally, #911 (dialled from a mobile DTMF pad) shall be used for emergency calls to the SCC and shall be separately identified at the consoles.
5. Capability shall be available at the consoles to voice log all conversations by way of an external digital voice recorder.

Operational Features

1. Newfoundland Power's preference is for the MRS operation to be similar to that that of its present system as described Appendix D.
2. Where operational differences may occur between Newfoundland and Labrador's planned MRS and Newfoundland Power's existing, these differences shall not cause the system to be less "user friendly" for Newfoundland Power users.

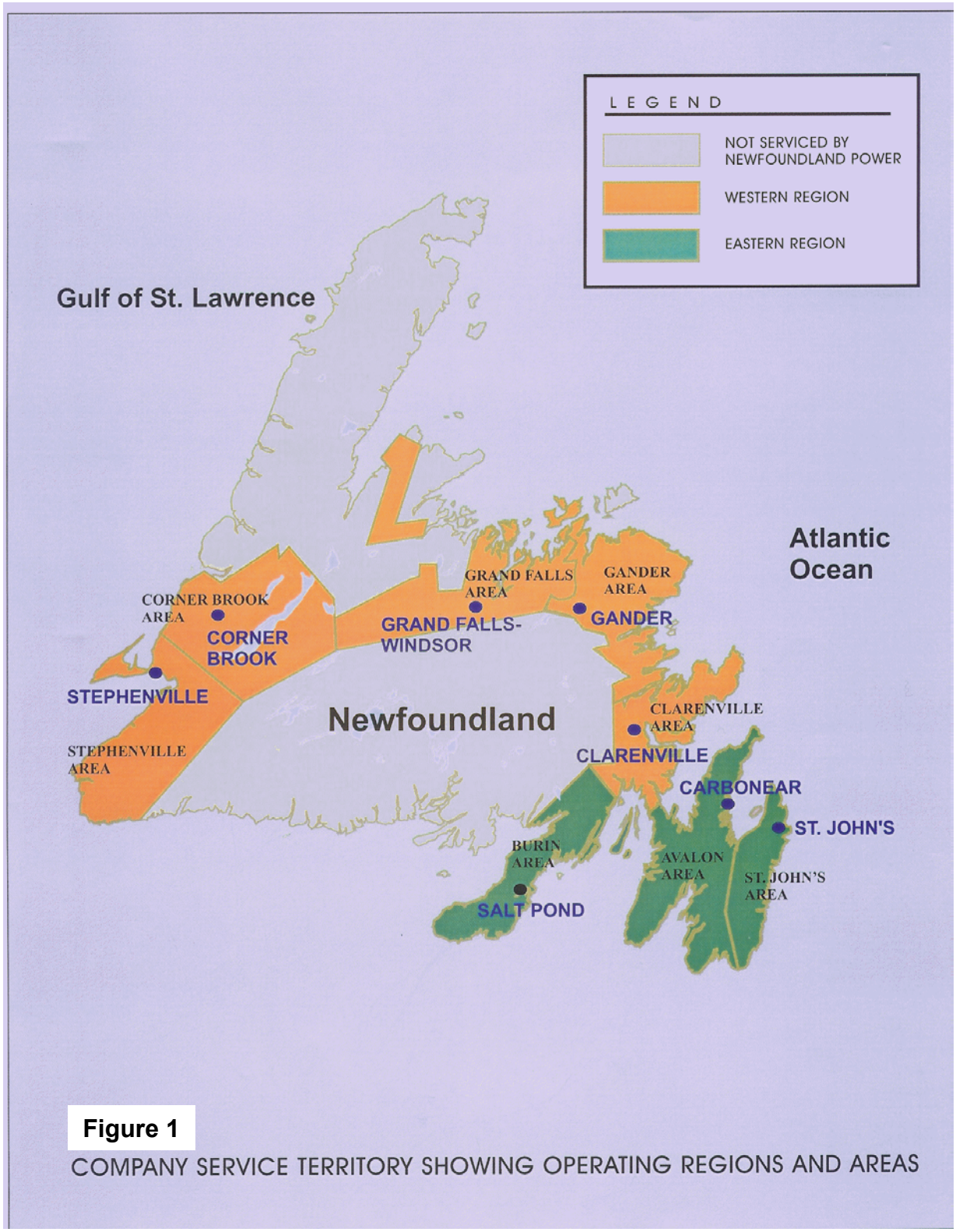


Figure 1

COMPANY SERVICE TERRITORY SHOWING OPERATING REGIONS AND AREAS

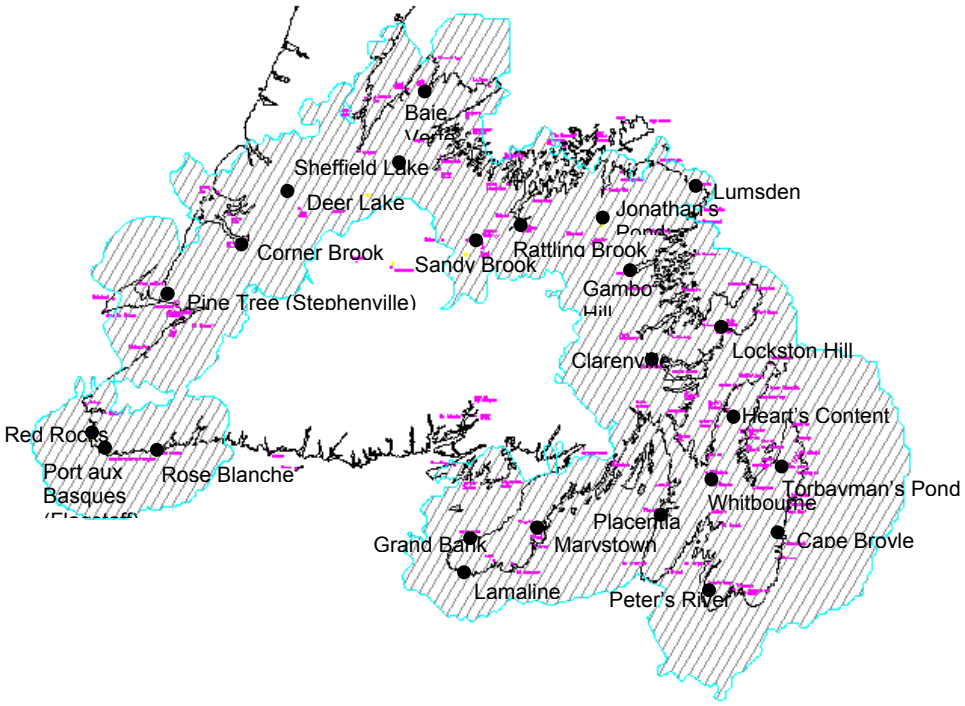


Figure 2 – Present VHF Radio Coverage

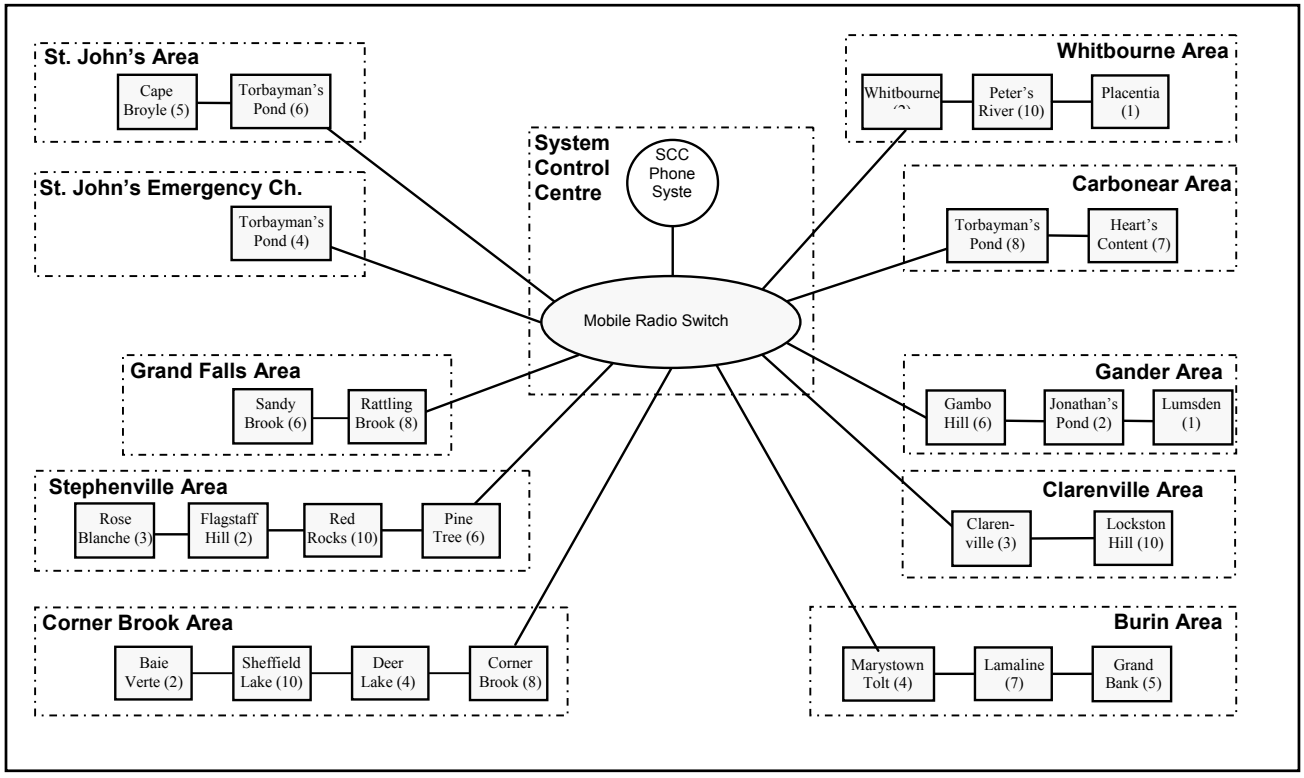


Figure 3 – Present Radio System Areas

APPENDIX 'A'

Newfoundland Power Contacts

▪ Jack Casey	Senior Engineer
▪ Gerry Walsh	Technologist
▪ George Durnford	Manager - Operations
▪ Geoff Emberley	Senior Engineer
▪ Brian Walsh	Manager – Western Region
▪ Scott Ainsworth	Superintendent - Operations
▪ Eugene Doyle	Superintendent – System Control
▪ Eugene Antle	Communications Technician - Burin
▪ Peter Upshall	Superintendent – Operations, Clarenville
▪ Eric Stevenson	Distribution Technician - Clarenville
▪ Line Crew	Clarenville
▪ Wallace Baker	General Foreman - Grand Falls
▪ Line Crew	Grand Falls
▪ Tom Hanlon	Hydro Plant Maintenance – Rattling Brook
▪ Byron Hayter	Hydro Plant Maintenance – Rattling Brook
▪ Bruce Oldford	Superintendent – Operations, Gander

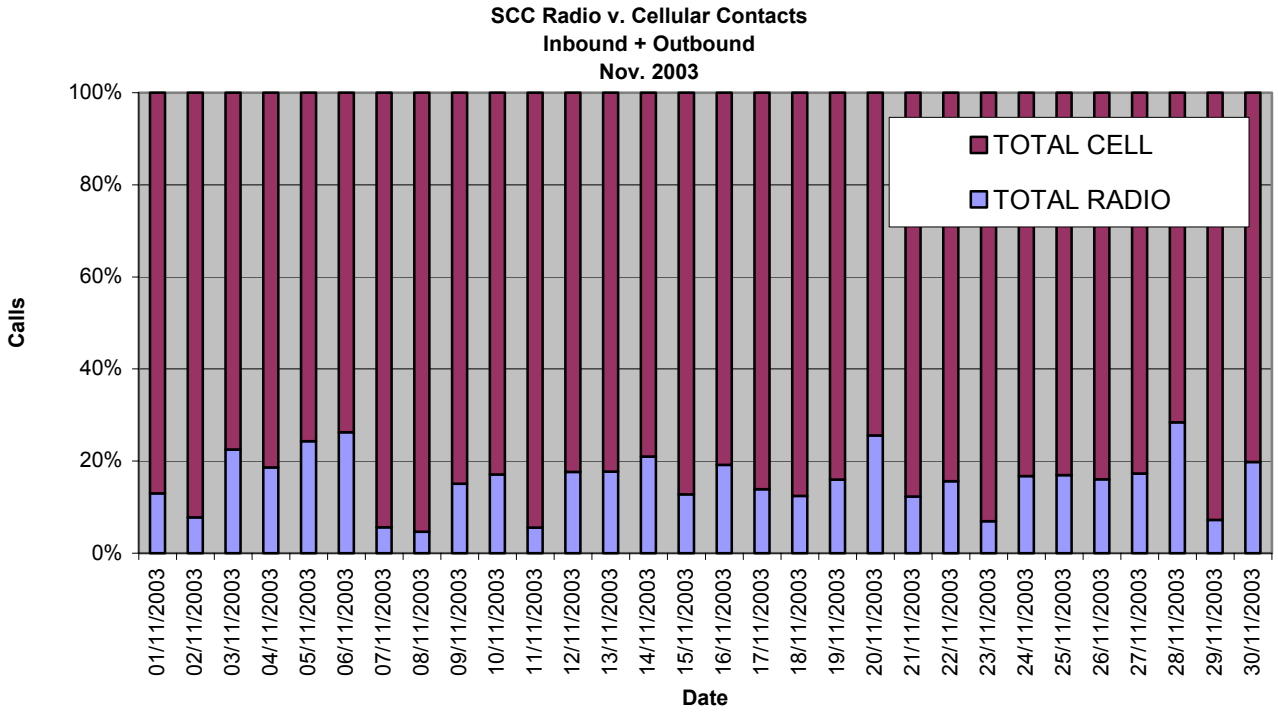
APPENDIX 'B'

RADIO AND CELLULAR USAGE DATA

Below is usage data for radio calls and cellular calls to/from the SCC during the month of November 2003.

DATE	RADIO OUT	CELL OUT	RADIO IN	CELL IN	TOTAL RADIO	TOTAL CELL
01-Nov-03	3	15	7	52	10	67
02-Nov-03	3	16	2	43	5	59
03-Nov-03	36	65	27	152	63	217
04-Nov-03	33	64	11	128	44	192
05-Nov-03	34	67	22	107	56	174
06-Nov-03	41	65	16	95	57	160
07-Nov-03	5	38	4	113	9	151
08-Nov-03	0	12	2	29	2	41
09-Nov-03	32	89	8	136	40	225
10-Nov-03	36	105	14	137	50	242
11-Nov-03	5	37	1	65	6	102
12-Nov-03	30	113	29	162	59	275
13-Nov-03	28	83	21	145	49	228
14-Nov-03	29	73	18	104	47	177
15-Nov-03	11	42	0	33	11	75
16-Nov-03	2	13	7	25	9	38
17-Nov-03	18	56	11	124	29	180
18-Nov-03	16	65	8	104	24	169
19-Nov-03	11	53	26	141	37	194
20-Nov-03	17	46	30	91	47	137
21-Nov-03	8	26	8	88	16	114
22-Nov-03	7	30	8	51	15	81
23-Nov-03	1	23	5	57	6	80
24-Nov-03	21	62	6	72	27	134
25-Nov-03	22	68	13	103	35	171
26-Nov-03	14	67	18	100	32	167
27-Nov-03	14	43	17	105	31	148
28-Nov-03	28	49	28	92	56	141
29-Nov-03	4	15	1	49	5	64
30-Nov-03	13	30	9	59	22	89

The chart below compares the quantity of radio calls and cellular calls in the preceding table on a percentage basis.



APPENDIX C

RADIO SITE DATA

Newfoundland Power Repeater Sites

Location	Lat. North	Long. West	Radio Equipment	Tx Power	Antenna Type	Antenna Height (meters)	Ground Elevation (meters)	Tx Freq (Mhz)	Rx Freq (Mhz)	Main Coverage Area
Torbaymans Pond Channel 4	47 30 19	52 51 55	MSF5000	96	SRL210C4	48.8	233	158.370	157.680	St. John's Backup Channel
Torbaymans Pond Channel 6	47 30 19	52 51 55	MSF5000	282	SRL210C4	65.5	233	159.630	158.250	St. John's and Bell Island
Cape Broyle NTC Microwave	47 04 41	52 57 05	MSR2000	123	Shared	70.0	145	160.485	163.125	Avalon Southern Shore
Hearts Content AT&T Microwave	47 49 49	53 18 33	MSR2000	123	SRL210C4	30.5	268	159.390	160.260	Trinity Bay
Whitbourne	47 26 51	53 32 33	MSR2000	200	SRL210C4	45.7	91	158.520	157.620	Whitbourne Area
Peter's River	46 44 41	53 33 42	MSR2000	123	SRL210C4	30.5	30	158.940	159.810	St. Mary's Bay Area
Placentia - Point Verde CBC Site	47 13 52	53 58 56	MSF5000	123	SRL210C4	90.0	115	166.560	160.725	Placentia Bay
Torbaymans Pond Channel 8	47 30 19	52 51 55	MSF5000	158	SRL210C4	53.4	233	158.430	159.180	Conception & Trinity Bay's
Lockston Hill	48 24 03	53 23 38	MSR2000	117	SRL210C4	12.2	153	158.940	159.810	Bonavista Area
Clarenville AT&T Microwave	48 11 21	54 02 24	MSR2000	126	SRL210C4	76.2	296	158.370	157.680	Clarenville Area
Marystown Tolt NTC Building	47 08 30	55 09 15	MSR2000	126	SRL210C4	10.6	170	158.370	157.680	Marystown - St. Lawrence
Grand Bank - Greenhill Turbine	47 05 25	55 45 05	MSR2000	98	SRL210C4	22.1	37	160.485	163.125	Fortune & Grand Bank
Lamaline NTC Microwave	46 52 05	55 48 23	MSR2000	123	SRL210C4	60.8	2	159.390	160.260	Lawn - Point May
Lumsden - NTC	49 17 58	53 36 32	**Leased**	125	**Leased**	25.0	31	166.560	160.725	Wesleyville, Lumsden
Gambo Hill	48 46 17	54 14 35	MSR2000	141	SRL210C4	45.7	168	161.325	164.760	Gambo & Terra Nova
Jonathon's Pond NTC Microwave	49 04 02	54 30 35	MSR2000	123	SRL210C4	51.8	137	158.520	157.620	Gander & Norte Dame Bay
Rattling Brook	49 04 10	55 16 58	MSR2000	141	SRL210C4	45.7	152	158.430	159.180	Grand Falls - Lewisporte
Sandy Brook	48 53 16	55 49 10	MSR2000	282	SRL210C4	45.7	137	159.630	158.250	Grand Falls & Badger
Baie Verte NTC Microwave	49 56 10	56 13 05	MSR2000	123	SRL210C4	45.7	225	158.520	157.620	Baie Verte & Seal Cove
Sheffield Lake NTC Microwave	49 21 42	56 33 24	MSR2000	123	SRL210C4	45.7	468	158.940	159.810	Springdale & Green Bay
Deer Lake NTC Microwave	49 15 23	57 30 29	MSR2000	126	Shared	45.7	400	158.370	157.680	Deer Lake & Howley
Corner Brook NTC Microwave	48 55 11	57 58 15	MSR2000	123	Shared	45.7	381	158.430	159.180	Bay of Islands
Pinetree Ridge Stephenville	48 35 23	58 39 44	MSR2000	126	SRL210C4	12.2	335	159.630	158.250	Bay St. George
Rose Blanche NTC	47 36 54	58 41 14	**Leased**	125	**Leased**	15.0	71	161.325	164.760	Rose Blanche Brook
Port Aux Basques CBC Flagstaff	47 34 47	59 08 45	MSR2000	126	SRL210C4	22.8	62	158.520	157.620	Port Aux Basques Area
Red Rocks NTC Microwave	47 40 35	59 18 10	MSR2000	126	Shared	45.7	60	158.940	159.810	Codroy Valley

APPENDIX 'D'

Newfoundland Power

Mobile Radio System Functionality

Jack Casey P. Eng.

January 2004

1.0 INTRODUCTION

The Newfoundland Power VHF radio system provides wireless voice communications to various mobile workers throughout the operating territory on the island portion of the province. The system is divided into nine areas corresponding to the operating areas of the Company. Within each area users can voice call other users anywhere regardless of which repeater they are tuned to. To make calls outside the area DTMF tones are used to complete switching necessary to establish links with remote areas or the System Control Centre (SCC).

Traffic is carried between the area and the radio switch located at the SCC using the corporate WAN. Four wire E&M interfaces are provided on the WAN routers located at various offices. The table below identifies the office where the various radio system interfaces are established.

Table D-1: Radio System Areas

Radio System	Interface Point
Stephenville & Port aux Basques	Corner Brook Service Building
Corner Brook & Baie Verte	Corner Brook Service Building
Grand Falls	Rattling Brook
Gander	Ratting Brook
Clarenville & Bonavista	System Control Centre
Burin	Salt Pond Office
Whitbourne & Peters River	Whitbourne Office
Carbonear	System Control Centre
St. John's	System Control Centre

VHF repeaters (radio sites) within an area are linked together via point-to-point radio and/or leased 4 wire E&M voice circuits. The E&M signalling is used to remotely key transmitters at linked repeater sites. This allows a signal inbound at one repeater site to be rebroadcast at other repeater sites. Ultimately all area radio systems are terminated at the network switch, located at the System Control Centre (SCC) in St. John's.

The connection of the SCC telephone system to the network switch enables the monitoring of calls from any Norstar key system multi-line telephone set in the SCC. The system offers the mobile radio user the flexibility to communicate with the SCC, another mobile and/or base station anywhere within the area, or other areas networked on the system. At present, the VHF radio system consists of 24 radio sites divided into nine areas. A tenth area exists as an emergency channel in the St. John's operating area.
The diagram below displays the network topology for the VHF radio system. The areas are grouped together into regions that better correspond to the corporate structure in existence at the time the radio system was designed. Also the repeater at Wesleyville marked future is in service, along with another similar unit at Rose Blanche on the Stephenville/Port aux Basques system.

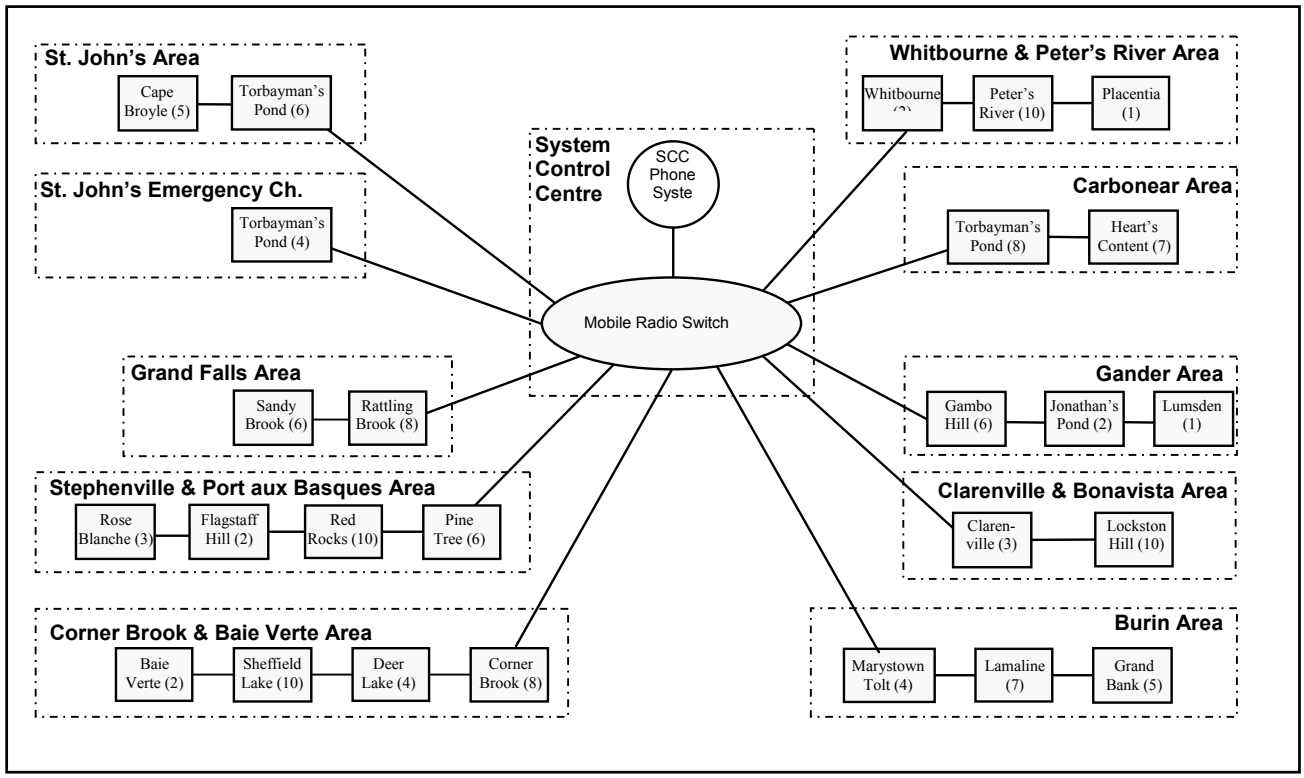


Figure D-1: VHF Radio System Overview

2.0 SWITCH FUNCTIONS

The radio switch incorporates the necessary network functions into the overall system design.

System Control Centre Access

The radio operator can access the system control centre by either one of the following three methods:

- Entering the code #438 on the DTMF microphone will ring the telephone set on the SCADA operators desk
- Entering the code #458 on the DTMF microphone will ring the telephone set on the dispatchers desk
- Entering the code #911 on the DTMF microphone will ring the emergency line on multiple telephone set in the SCC

Access to Other Areas

The radio operator can access other areas by entering the appropriate DTMF code on their radio microphone. The table below lists the various link access codes. The radio switch detects these codes and the links are established.

Table D-2: Area Interconnect Codes

AREA	ACCESS CODE
St. John's (6) + St. John's (4)	**#901**
Bonavista + Burin	**#905**
St. John's (4) + Bonavista	**#908**
St. John's (4) + Burin	**#909**
Gander + Bonavista	**#914**
Gander + Burin	**#915**
Gander + Grand Falls	**#916**
Grand Falls + Corner Brook	**#917**
Corner Brook + Stephenville	**#918**
Grand Falls + Stephenville	**#919**
St. John's (6) + Whitbourne	**#920**
St. John's (4) + Whitbourne	**#921**
St. John's (6) + St. John's (4) + Whitbourne	**#923**
Bonavista + Whitbourne	**#924**
Burin + Whitbourne	**#925**
Whitbourne + Carbonear (7,8)	**#927**
Carbonear (7,8) + Bonavista	**#928**

Entering the code #* on the DTMF microphone will reset the switch if there is any difficulty making or terminating a connection.

Telephone System Access

The system provides for the ability for allow telephone lines in the Newfoundland Power Centrex group (restricted to St. John's only) to access the VHF Mobile Radio system. To use this facility, dial ***79** from any Centrex telephone and a second dial tone will be presented. Dial the access code for the area in which you wish to connect with and a tone will be heard indicating the user has connected to the radio system. Telephone access codes for each area are listed in the table below.

When using the telephone to speak over the radio system some issues must be kept in mind. The telephone operates in full duplex mode while the radio system is only half duplex. What this means that if the radio operator is speaking on the radio, he will not be able to hear anything spoken by the telephone user. Therefore when using the telephone access feature, both the telephone user and the radio operator should finish each transmission with the word "**OVER**".

Table D-3: Telephone System Access Codes

AREA	ACCESS CODE	MONITORING CODE
St. John's Channel 6	**60**	**571**
St. John's Channel 4	**61**	**572**
Carbonear	**62**	**576**
Bonavista	**63**	**574**
Burin	**64**	**575**
Whitbourne	**65**	**581**
Gander	**66**	**580**
Grand Falls	**67**	**582**
Corner Brook	**68**	**583**
Stephenville	**69**	**584**

3.0 AREA RADIO SYSTEM DESCRIPTIONS

St. John's Area

The St. John's area VHF radio system consists of two VHF repeaters, one repeater located at Torbayman's Pond (Trans Canada Highway near the Donovan's Industrial Park) and the second repeater at Aliant's site in Cape Broyle. The channel 6 repeater at Torbayman's Pond and the channel 5 repeater at Cape Broyle are permanently linked together. These repeaters are connected to the network switch at the SCC via a leased 4-wire E&M voice circuit.

A second repeater is also located at Torbayman's Pond. This repeater operates on channel 4 and is available for emergency use in the St. John's area.

Carbonear Area

The Carbonear area VHF radio system consists of two VHF repeaters, one repeater located at Torbayman's Pond (Trans Canada Highway near the Donovan's Industrial Park) and the second repeater at AT&T's site on the Hearts Content Barons. The channel 8 repeater at Torbayman's Pond and the channel 7 repeater at Hearts Content are permanently linked together. These repeaters are connected to the network switch at the SCC via a 4-wire E&M voice circuit on a T1 link leased from AT&T.

Whitbourne Area

The Whitbourne area VHF radio system consists of three VHF repeaters, one repeater located at Whitbourne and the second repeater at Peter's River and a third at CBC's site at Point Verde. The channel 2 repeater at Whitbourne is linked to the channel 10 repeater at Peter's River and the channel 1 repeater at Point Verde using on air RA repeater. These repeaters are connected to the network via a leased 4-wire E&M voice circuit from the Whitbourne radio site to the Whitbourne office. Connection to the radio switch at the SCC is via the corporate network.

Clarenville and Bonavista Area

The Clarenville area VHF radio system consists of two VHF repeaters, one repeater located at Aliant's cell site at Lockston and the second repeater at AT&T's site at Steele's Mountain Clarenville. The channel 10 repeater at Lockston and the channel 3 repeater Clarenville are permanently linked together using on air RA repeater. These repeaters are connected to the network switch at the SCC via a 4-wire E&M voice circuit on a T1 link leased from AT&T.

Burin Area Radio System

The Burin area VHF radio system consists of three VHF repeaters, one repeater located at Aliant's Marystown Tolt site, the second repeater at Aliant's Lamaline site and a third at Greenhill substation. The channel 4 repeater at Marystown Tolt is linked to the channel 7 repeater at Lamaline and the channel 5 repeater at Greenhill using on air RA repeater. These repeaters are connected to the network via a leased 4-wire E&M voice circuit from the Marystown Tolt radio site to the Salt Pond office. Connection to the radio switch at the SCC is via the corporate network.

Gander Area Radio System

The Gander area VHF radio system consists of three VHF repeaters, one repeater located at Aliant's Jonathan's Pond site, the second repeater at Newfoundland Power's Gambo Hilltop site and a third at Aliant's Lumsden cell site. The channel 2 repeater at Jonathan's Pond is linked to the channel 6 repeater at Gambo Hilltop using a UHF point to point radio link. The channel 1 repeater at Lumsden is linked to the network using on air RA repeater. These repeaters are connected to the network via a 4-wire E&M voice circuit from Newfoundland Power's office at Rattling Brook.

Grand Falls Area Radio System

The Grand Falls area VHF radio system consists of two VHF repeaters, one repeater located at Rattling Brook Hilltop site, and the second repeater at Sandy Brook site. The channel 8 repeater at Rattling Brook is linked to the channel 6 repeater at Sandy Brook using a UHF point to point radio link. These repeaters are connected to the network via a 4-wire E&M voice circuit from Newfoundland Power's office at Rattling Brook.

Corner Brook Area Radio System

The Corner Brook area VHF radio system consists of four VHF repeaters at Aliant sites located, at Corner Brook, Deer Lake, Sheffield Lake and Baie Verte. The four repeaters are connected together by a multi-drop circuit from Aliant and delivered to the maple Valley Corner Brook office on a 4-wire E&M circuit. Connection to the radio switch at the SCC is via the corporate network.

Stephenville Area Radio System

The Stephenville area VHF radio system consists of four VHF repeaters, two at Newfoundland Power sites at Pinetree Ridge and Flagstaff Hill and two at Aliant site located at Red Rocks, at Rose Blanche. Three of the repeaters are connected together by a multi-drop circuit from Aliant and delivered to the maple Valley Corner Brook office on a 4-wire E&M circuit. The Rose Blanche repeater is an RA configuration that picks up the Flagstaff repeater on the air. Connection to the radio switch at the SCC is via the corporate network.

4.0 SYSTEM FEATURES

The following is a list of essential features that should be maintained based upon a high frequency of usage:

Area repeaters permanently linked together

The ability for radio operators to voice call other mobile users anywhere within the existing operating areas provides for a simple means of communications between work crews.

Access to SCC

The ability for radio operators to selectively call the System Control Centre using their DTMF microphone to dial #438 to reach the SCADA Operator, #458 to reach the Dispatcher and #911 for emergencies will be maintained.

Operational voice handsets SCC

The existing radio/telephone sets at the SCC provide access to both the telephone and radio systems. Each SCADA Operator and the Dispatcher have the capability to access all telephone lines (incoming and outgoing) and radio trunks. The sets have a dial by name feature that is hierarchical in nature to allow for easy selection based upon job function and employee location. The operator gets an acknowledgement tone in the earpiece when the connection is made through to the repeater.

Voice logging

The existing radio/telephone sets at the SCC are connected to a digital voice logger. This logger records all conversations with the staff at the SCC make on the telephone or radio systems.

The following is a list of nonessential features that are not frequently of used. Therefore there is some flexibility in how this functionality is accomplished in any future redesign of the radio system.

Area repeaters linked to remote areas

The ability for radio operators to link their area radio system to a remote area radio system is used infrequently. This feature is used in times of trouble when supervisors are looking for updates from crews working in an area remote from the supervisor's location. This feature should be maintained in some form if possible, but can be implemented differently from what is currently in place.

Telephone system access

The current functionality where a Centrex telephone line can access the VHF radio system is used infrequently. Some Head Office staff attempt to communicate with an employee in a VHF radio equipped vehicle using this feature. Usually the first attempt to communicate with the employee is by cellular telephone. This feature is useful in the event that the cellular system is unavailable due to poor coverage or cellular system congestion. While it would be inconvenient, it would be possible to have the staff at the SCC relay messages via the VHF radio system for office staff.

VHF radio paging

With the advent of cellular telephones the use of the VHF paging system has been discontinued.

VHF radio switch reset

The design of the existing system was intended to provide a simple user interface for the mobile radio user. An all encompassing "fix all" code of #* was implemented to reset the switch and trunks. This feature was most frequently used by radio operators to terminate an inter-area radio call rather than wait for the connection to time out. While the #* code itself is not essential, a reset of some type must be maintained.

TABLE D-4: NP VHF FREQUENCY CHANNEL ASSIGNMENT

CHANNEL	TRANSMIT (MHz)	RECEIVE (MHz)	REPEATER SITE
1	166.560	160.725	**Placentia – CBC** **Lumsden - NTC**
2	158.520	157.620	**Baie Verte - NTC** **Flagstaff - CBC** **Jonathon's Pond - NTC** **Whitbourne**
3	161.325	164.760	**Clarenville - AT&T** **Rose Blanche - NTC**
4	158.370	157.680	**Deer Lake - NTC** **Marystown Tolt - NTC** **Torbayman's Pond**
5	160.485	163.125	**Cape Broyle - NTC** **Grand Bank (Greenhill)** **Millertown - NTC**
6	159.630	158.250	**Gambo Hilltop** **Pinetree Ridge** **Sandy Brook** **Torbayman's Pond**
7	159.390	160.260	**Hearts Content - AT&T** **Lamaline - NTC**
8	158.430	159.180	**Corner Brook - NTC** **Rattling Brook** **Torbayman's Pond**
9	159.940	159.940	**Vehicle to Vehicle**
10	158.940	159.810	**Lockston Hill** **Peter's River** **Red Rocks - NTC** **Sheffield Lake - NTC**
11	160.485	160.485	**Vehicle to Vehicle**
12	158.520	158.520	**Vehicle to Vehicle**

APPENDIX 'E'

VHF RADIO SITE SELECTION FOR NEWFOUNDLAND POWER

Based on known and predicted coverage characteristics, the following is a list of sites that would be acceptable to Newfoundland Power (NP) for VHF radio coverage of its service territory.

Figure E-1 shows how these sites would be grouped into radio system areas using a conventional mobile radio architecture like NP uses at present.

1. **Torbayman's Pond (NP)**
   a. Site and equipment is 100% owned by NP.
   b. Power consists of battery backup and standby generator.
   c. 3 VHF radio channels.
   d. Linked to SCC via telephone lines leased from Aliant.
   e. *Assumption:* Acceptable to NLH in place of their existing Kenmount Hill site.
   f. *Potential issue:* Building space

2. **Cape Broyle (NP)**
   a. Aliant site where NP owns 1 VHF repeater and shares Aliant's antenna.
   b. Linked to SCC over telephone line leased from Aliant.
   c. *Assumption:* Not required by NLH

3. **Whitbourne (NP)**
   a. Site and equipment is 100% owned by NP.
   b. Power consists of battery backup and standby generator.
   c. 1 VHF radio channel.
   d. Peter's River is linked to Whitbourne via VHF radio.
   e. Linked to NP's Whitbourne office via telephone line and to SCC via corporate WAN, leased from Aliant.
   f. *Assumption:* Acceptable to NLH in place of their planned Chapel Arm site.
   g. *Potential issue:* Building space
   h. *Alternate scenario:*
      i. Use NLH site at Chapel Arm in place of Whitbourne.
      ii. Acceptable if a Chapel Arm – Peter's River and Chapel Arm – Placentia VHF links are possible.

4. **Peter's River (NP)**

   a. Site and equipment is 100% owned by NP.
   b. Power consists of battery backup and standby generator.
   c. 1 VHF radio channel.
   d. Linked via VHF radio to Whitbourne.
   e. *Assumption:* Not required by NLH.
   f. *Potential issue:* If Chapel Arm is used to replace NP's existing Whitbourne site, a Peter's River – Chapel Arm link will be required.

5. **Heart's Content (NP)**

   a. AT&T site where NP owns 1 VHF repeater and antenna.
   b. Linked to SCC over T-1 line leased from AT&T.
   c. *Assumption:* Not required by NLH

6. **Placentia (NP)**

   a. CBC site where NP owns 1 VHF repeater and antenna.
   b. Linked to NP's Whitbourne office via telephone circuit and to SCC via corporate WAN, leased from Aliant.
   c. *Assumption:* Not required by NLH.
   d. *Potential issue:* If Chapel Arm is used to replace NP's existing Whitbourne site, a Placentia – Chapel Arm link will be required.

7. **Bull Arm (NLH)**

   a. NLH site that will provide improved coverage for NP in the Swift Current area.
   b. New repeater here for NP will need to be bridged with Clarenville and Lockston Hill.

8. **Clarenville (NLH)**

   a. NLH site that NP will use in place of nearby AT&T site.
   b. At the AT&T site, NP has one VHF repeater, an antenna and the site is linked to the SCC via a T-1 circuit leased from AT&T.
   c. Lockston Hill is linked to Clarenville via VHF radio, hence this link must be re-established to NLH site from the present AT&T site.

9. **Lockston Hill (NP)**

   a. Aliant site where NP owns one VHF repeater, antenna and pole (for mounting antenna).
   b. Linked via VHF radio to Clarenville.
   c. *Assumption:* Not required by NLH

10. **Bay L'Argent (NLH)**

    a. Site owned by Aliant but presently used by NLH, but *not* used by NP.

b. This site would be of value to NP for improved coverage of the Bay L'Argent area.
c. *Assumption:* A new repeater here for NP can be linked to Marystown via a VHF radio link.

11. **Marystown (NP)**

a. Aliant site where NP owns 1 VHF repeater, antenna and pole (for mounting antenna).
b. Linked to NP's Salt Pond office via telephone circuit and to SCC via corporate WAN, leased from Aliant.
c. *Assumption:* NLH will want to use this site.

12. **Lamaline (NP)**

a. Aliant site where NP owns 1 VHF repeater and antenna.
b. Linked to NP's Salt Pond office via telephone circuit and to the SCC over the corporate WAN, leased from Aliant.
c. *Assumption:* Not required by NLH

13. **Grand Bank**

a. Site and equipment is 100% owned by NP.
b. Site power has battery backup.
c. Linked to NP's Salt Pond office via telephone circuit and to the SCC over the corporate WAN, leased from Aliant.
d. *Assumption:* Not required by NLH

14 **Gambo Hill (NP)**

a Site and equipment is 100% owned by NP.
b Power consists of battery backup and standby generator.
c 1 VHF radio channel.
d Linked to Rattling Brook via UHF radio link (owned by NP) and to SCC via the corporate WAN, leased from Aliant.
e *Assumption:* Acceptable to NLH in place of their planned Square Pond Hill site.
f *Potential issue:* Building space.
g *Alternate scenario:*
  i Use NLH site at Square Pond Hill in place of Gambo Hill.
  ii Two concerns here that would need to be resolved are: (i) Square Pond Hill could result in reduced coverage of the Easport Peninsula and Route 320 (Gambo – Wesleyville) and (ii) a VHF radio link from Square Pond Hill to Lumsden may not be feasible due to excessive terrain blockage.
  iii Square Pond though could perhaps contribute to the elimination of NP's present Jonathan's Pond site.

15 **Lumsden (NP)**

a Aliant owns site and all equipment which is leased NP.
b Linked to Gambo Hill via VHF radio.
c *Assumption:* Not required by NLH.
d *Potential issue:* If Square Pond Hill is used to replace NP's existing Gambo Hill site, the present VHF radio may not be feasible to link Lumsden to Square Pond Hill.

16 **Jonathan's Pond (NP)**

a Aliant site (land and tower) where NP has a building with its own equipment – radio, antennas, power, etc.
b Power consists of battery backup and standby generator.
c Linked to Rattling Brook via UHF radio link (owned by NP) and to SCC via the corporate WAN, leased from Aliant.
d *Assumption:* NLH will want to use this site.
e *Potential issue:* Elimination of Rattling Brook will require that a new route will be required for the UHF link (item 'c' above) – perhaps to Notre Dame.
f *Alternate scenario:* Should NP choose to use NLH sites at Square Pond Hill and Carmanville, Jonathan's Pond may not be needed.

17 **Notre Dame (NLH)**

a Acceptable to NP in place of its existing Rattling Brook site.

18 **Sandy Brook Hill** (NLH)

a Acceptable to NP in place of its own Sandy Brook site (will provide greater coverage).

19 **Sheffield Lake (NP and NLH)**

a Aliant site where NP has one 1 VHF repeater and antenna.
b Linked to Corner Brook via telephone circuit and to SCC via corporate WAN.
c Sheffield also used by NLH.

20 **Baie Verte (NP)**

a Aliant site where NP has one 1 VHF repeater and antenna.
b Linked to Corner Brook via telephone circuit and to SCC via corporate WAN.
c *Assumption*: NLH will want to use this site.

21 **Deer Lake (NP)**

a Aliant site where NP has one 1 VHF repeater and antenna.
b Linked to Corner Brook via telephone circuit and to SCC via corporate WAN.
c *Alternate scenario:*
  i Use NLH site at Blue Grass Hill in place of Deer Lake.

ii Concern here is that NP coverage will be reduced at Wiltondale and on TCH between Deer Lake and Corner Brook.

22 **Corner Brook (NP and NLH)**

a Aliant site where NP has one 1 VHF repeater and antenna.
b Linked to Corner Brook via telephone circuit and to SCC via corporate WAN.
c Corner Brook also used by NLH.

14. **Pine Tree (NP)**

a. Site and equipment is 100% owned by NP.
b. Power consists of battery backup and standby generator.
c. 1 VHF radio channel.
d. Linked to Corner Brook via telephone circuit and to SCC via corporate WAN.
e. *Assumption:* Acceptable to NLH in place of their existing Stephenville site.
f. *Potential issue:* Building space
Reduced coverage for NLH towards Corner Brook

23 **Red Rocks (NP and NLP)**

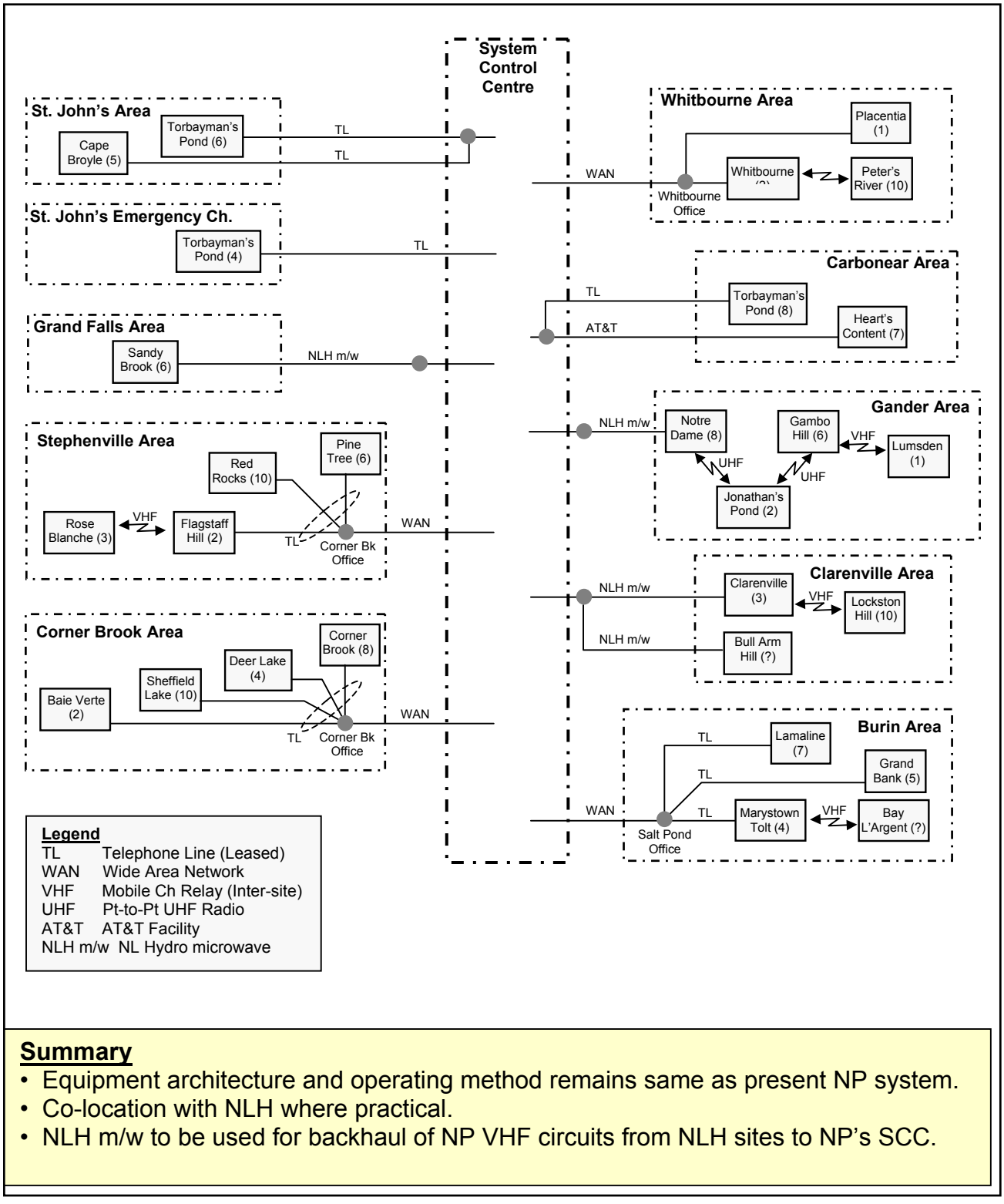
a Aliant site where NP has one 1 VHF repeater and antenna.
b Linked to Corner Brook via telephone circuit and to SCC via corporate WAN.
c Red Rocks also used by NLH.

24 **Port aux Basques (NP)**

a CBC site (land and tower) where NP has a building with its own equipment – radio, antennas, power, etc.
b Power consists of battery backup and standby generator.
c Linked to Corner Brook via telephone circuit and to SCC via corporate WAN.
d *Assumption*: Not required by NLH.

25 **Rose Blanche**

a Aliant owns site and all equipment which is leased NP.
b Linked to Port aux Basques via VHF radio.
c *Assumption:* Not required by NLH.



Summary

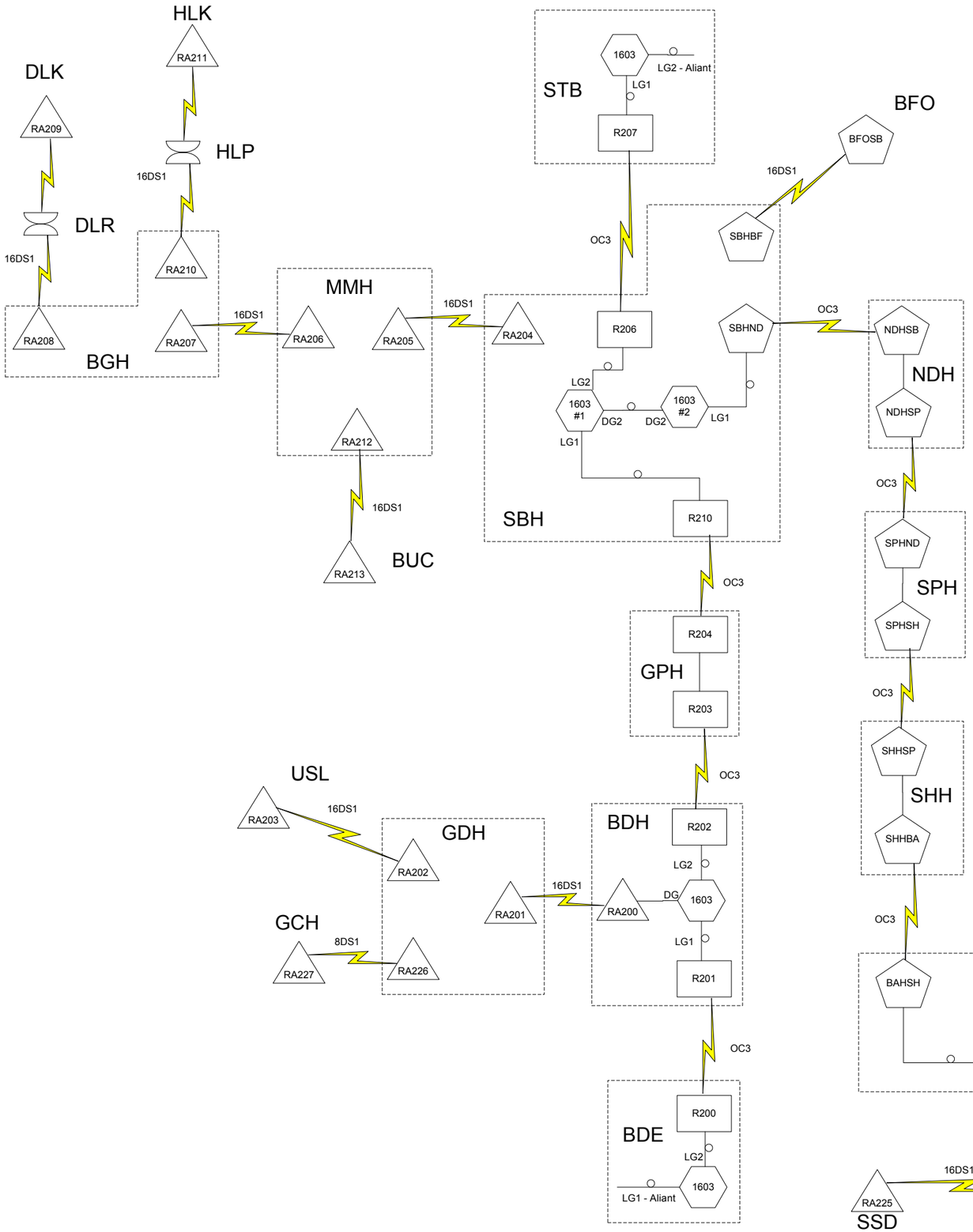
- Equipment architecture and operating method remains same as present NP system.
- Co-location with NLH where practical.
- NLH m/w to be used for backhaul of NP VHF circuits from NLH sites to NP's SCC.

Figure E-1: NP Radio System Areas – Alternative 1

ATTACHMENT 3

Newfoundland and Labrador Hydro
Microwave Radio Network

N. Walsh	04/02/25	Rev 2



LEGEND:

- XXXXX — MDR 4000
- XXXXX — MDR 6000
- XXXXX — MDR 8000
- 1603 — 1603
- PASSIVE REPEATER

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
1	**CUSTOM**																													
2	**SYSTEMS**												**MRS Replacement Costs (less HST)**															**ATTACHMENT 4**		
3	**ELECTRONICS**	LIMITED											**NLH MRS with NPI Option B**															Sheet 1 of ___.		
4	Prepared by: _____					<----------Repeater Site---------->																						Rev 20040313-Rev00		
5		**Existing**				<----------Common---------->				<---------- Rpt/Cntl---------->			<----------Backhaul Link---------->			<----------Site Installation---------->		<--------MRS Switch Options--------->			<-----------MRS Comaptible VHF User Equipment----------->						
6	**Site Name**	Aliant"√"&	**Owner**	**Site Availability &**	**Site Sharing**	**Bldg.**	**Tower**	**Power**	**Ant.Syst***	**(Include Switch Portion if Distributed)**			**Specify Interface Requirments**				**Total**	**Add Cost**	**Distributed,or Redundant**			<----Insert Mfg & Model #s------->			<--Insert Ind. Canada-->		**Vendor Notes:**		
7	**ISLAND:**	/orNew"X"	**(User)**	**Contact**	**Voice Traffic**					**$, Atl # 1**	**$, Alt # 2**	**$, Option B**	**$, Ati # 1**	**$, Alt # 2**	**$, Option B**	**M-Day+Exp**	**Site Total**	**$, Option B**	**$, Alt # 1**	**$, Alt # 2**	**Option B**	**Mobile**	**Portable**	**Base Stn**	**Type Approval #**				
8	Annieopsquotch	√ & X	Aliant(NLH)	NLH Only	NLH/WST	Aliant	Exists		Exists																					
9	Bay d'Espoir Hill	√ & X	NLH	NLH Only	NLH/WST	NLH	Exists	NLH	Exists																					
10	Bay l'Argent	B, √, & X	Aliant(NLH)	Utility share	NLH/NP/WST	Aliant	Exists		Exists																					
11	Blue Grass Hill	Opt.B √&X	NLH	Utility share?	NLH/NP/WST	NLH	NLH		Exists																					
12	Blue Mountain	√ & X	Aliant(NLH)	NLH Only	NLH/WST	NLH	Exists		Exists																					
13	Bonne Bay(ThreeTom)	√ & X	Aliant(NLH)	NP Only	NLH/WST	Aliant	Exists	NTM	Exists																					
14	Baie Verte	**Opt.B & X**	Aliant(NP)	Utility share	NLH/NP/WST	NLH	Exists	NT	Exists																					
15	Brent's Cove	√ & X	Aliant(NLH)	NLH Only	NLH/WST	Aliant	Exists		Exists																					
16	Bull Arm	Opt B & X	NLH	Utility share?	NLH/NP/WST	NLH	Exists	Planned																						
17	Carmanville	Opt B, √ & X	Aliant(NLH)	Utility share?	NLH/NP/WST	Aliant	Exists	NTM	Exists																					
18	**Cape Broyle**	**Opt. B**	Aliant(NP)	NP Only	NP/WST	Aliant	Exists	NT																						
19	Shoal Harbour (Clvlle)	**Opt.B √&X**	NLH	Utility Share	NLH/NP/WST	NLH	Exists	Exists																						
20	Codroy	√ & X	Aliant	NLH Only	NLH/WST	Aliant	Exists	NTM	Exists																					
21	Corner Brook	**Opt.B √&X**	Aliant	Utility share	NLH/NP/WST	Aliant	Exists	36 hr?	Exists																					
22	Deer Lake		NLH	NLH	MRS Switch	NLH Office		Exists																						
23	FourMilePdl(HawkeHills)	√	Aliant(NLH)	NLH Only	NLH/WST	NLH	Exists																							
24	Flagstaff Hill (PaB)	**Opt. B**	CBC (NP)	NP Only	NLH/NP/WST	NPI	Exists																							
25	Gambo	Alternative	Aliant	NP Onlly		Aliant	Exists																							
26	Godaleich Hill	√ & X	NLH	NLH Only	NLH/WST	NLH	Exists		Exists																					
27	Grand Bank	**Opt. B**	NP	NP Only	NP/WST	NP	Exists																							
28	Granite Canal	X	NLH	NLH Only	NLH	NLH	Exists	Exists																						
29	Gull Pond Hill	X	NLH	NLH Only	NLH/WST	NLH	Exists																							
30	Heart's Content	**Opt. B**	ATT(NP)	NP Only			Exists																							
31	Hermitage	√ & X	Aliant	NLH Only	NLH/WST	Sect	Exists	36 hr bat?	Exists																					
32	Jackson's Arm	√ & X	Aliant	NLH Only	NLH/WST	Sect	Exists	36 hr bat?	Exists																					
33	Johnathan'sPd(Gander)	Opt. B	Aliant(NP)	NP NLH SPH & Carmenvll?		NLH	Exists																							
34	Lamaline	**Opt. B**	Aliant(NP)	NP Only	NP/WST	Sect	Exists																							
35	Lockston	**Opt. B(oa)**	Aliant(NP)	NP Only	NP/WST	Sect	Exists	Exists																						
36	Lumsden	**Opt. B(oa)**	Aliant(NP)	NP Only	NP/WST	Sect	Exists	Exists																						
37	Mary March Hill	**Opt. B & X**	NLH	Utility share	NLH/NP/WST	NLH	Exists																							
38	**Marystown Tolt**	**Opt.B & X**	Aliant(NP)NP	Utility share	NLH/NP/WST	Aliant	Exist/New	36 hr bat?																						
39	Mount Margaret	√	Aliant	NLH Only	NLH/WST	Aliant	ExistsNLH	36 hr bat?	Exists																					
40	Notre Dame Hill	**Opt.B & X**	NLH (NLH)	Utility share	NLH/NP/WST	Exists	New NLH																							
41	Peter's River	**Opt. B(oa)**	NP	NP Only	NP/WST		Exists	Exists																						
42	Petty Hr. Long Pd.	X	NLH	NLH Only if not Torbayma	NP/WST	NP	Planned																							
43	PineTreeRidge (Svl)	**Opt. B**	DOT (NP)	NP Only	NP/WST/NLH																									
44	Placentia	**Opt. B(oa)**	CBC(NP)	NP Only	NP/WST	NP	Exists																							
45	Port Saunders	√ & X	Aliant(NLH)	NLH Only	NLH/WST	Aliant	Exists		Exists																					
46	Portland Creek	√ & X	Aliant(NLH)	NLH Only	NLH/WST	Aliant	Exists		Exists																					
47	Red Rocks	**Opt.B,√&X**	Aliant(NLH)	Utility Share	NLH/NP/WST	Aliant	Exists		Exists																					
48	Rocky Ridge	√ & X	Aliant	NLH Only	NLH/WST	Aliant	Exists		Exists																					
49	Rose Blanche	**Opt. B**	Aliant(NP)	NP Only	NP/WST	Aliant																								
50	Sandy Bk Hill	**Opt. B & X**	NLH	Utility Share	NLH/NP/WST	NLH	Exists																							
51	Sheffield	**Opt B,√&X**	Aliant(NLH)	Utility Share	NLH/NP/WST	Aliant	Exists		Exists																					
52	Southwest Brook	√ & X	Aliant	NLH Only	NLH/NP/WST	Aliant	Exists		Exists																					
53	StJohn's ECC HydroPl.		NLH	MRS Redundant Switch	NLH Office		Exists																							
54	St. Anthony	√ & X	Aliant(NLH)	NLH Only	NLH/WST	Aliant	Exists		Exists																					
55	Stephenville	√ & X	Aliant(NLH)	NLH Only	NLH/NP/WST	Aliant	Exists		Exists																					
56	Square Pond Hill	Opt.B, & X	NLH (NLH)	NPI Share(repl Jonathan?)		Exists	Exists																							
57	Torbayman's Pd	Opt. B & X	NP(NP)	Utility Share,Bldg Space?	NP/NLH/WST	NP	Exists																							
58	Whitbourne	**Opt. B**	**(NP)**	NP Only		NP	Exists																							
59	**Labrador:**																													
60	L'Anse au Loup	X	Aliant	NLH Only	NLH/WST		Exists																							
61	Woody	X	Aliant	NLH Only	NLH/WST		Exists																							
62	Mary's Harbour	X	Aliant	NLH Only	NLH/WST		Exists																							
63	Lab.City/Wabush	X	Aliant	NLH Only	NLH/WST		Exists																							
64	HappyValley/Goose Bay	X	Aliant	NLH Only	NLH/WST		Exists																							
65																														
66						**Sub Total - Antenna System (new sites)**				_____	Not Applicable	Not Applicable	Not Applicable	Not Applicable																	
67		**KEY:**				**Multiplex Cards**				Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable																	
68		**Column B:**				**Technology 1 - Fixed Equipt**				Not Applicable	_____	Not Applicable	Not Applicable	_____																	
69		-New NLH VHF Site "X"				**Technology 2 - Fixed Equipt**				Not Applicable	Not Applicable	_____	Not Applicable	Not Applicable	_____	_____															
70		-Option B NPI Site "B"				**Incremental Expans'n for NPI (OptionB)**				_____	_____	_____	_____																	
71		-Existing NLH Site/backhl "√"				**Mobile Data Switch**				Not Applicable	_____	_____																		
72		-If "B" not bold text (Option B), then				**Building & Tower Upgrades**				Not Included	Not Applicable	Not Applicable	Not Applicable																	
73		feedback from NP to NLH Pending				**User Equipment**				Not Applicable	Not Applicable	Not Applicable	Not Applicable																	
74						**Adjacent Site Link Capital**				Not Included	Not Applicable	Not Applicable	Not Applicable																	
75						**Link Radio (Adjac. Site) Engr'g/PathDsn**				Not Included	Not Applicable	Not Applicable	Not Applicable	Not Applicable																	
76						**Newfoundland Hydro Internal**				Not Included	Not Applicable	Not Applicable	Not Applicable	Not Applicable																	
77	**Annual Charges:**					**Engineering Design**				_____	_____	_____	_____																	
78						**FATest; Proj. Mgmt; Train; Docu.**				Not Applicable	_____	_____	_____																	
79	Alarm Monitoring (if separate)					**Network Services (one time)**				_____	_____	_____	_____																	
80	Maintenance					**Coverage Plots for Design**				Not Applicable	Not Applicable	Not Applicable	Not Applicable																	
81	Software Support					**Installation (40 sites)**				_____	_____	_____	_____																	
82	Industry Canada Licenses:					**Installation (Option B add 9 sites)**				_____	_____	_____	_____	_____	_____	_____	_____	_____	_____		_____									
83	Rented (Leased) Lines					**Labrador site preparation (new sites)**				_____	_____	_____	_____																	
84	Tower & Space Rentals (25 Aliant sites)					**Alarm System (integrated w. MRS)**				_____	_____	_____	_____						_____											
85	Tower & Space Rentals (Opt B add 11 Aliant sites)					**Spares**				_____	_____	_____	_____	_____	_____	_____		_____												
86	**Total Annual (40 sites):**					**Vendor Contingency**				_____	_____	_____	_____	_____	_____	_____		_____	_____	_____	_____									
87	**Total Annual (Opt B = Total 55 sites):**					**Training & Documentation**				Not Applicable	_____	_____	_____	_____	_____	_____		_____	_____	_____	_____									
88						**Contingency (Internal Hydro Use Only)**																									
89				_____		**ADD: Option B Contingency (Hydro)**				_____	_____	_____	_____																	
90						**S. Totals Capital (less HST):**																									
91										_____	_____	_____	_____																	
92						**Total Capital less User equipment**				_____	_____	_____	_____																	

ATTACHMENT 5.
Table of Contents 5 Pages

NEWFOUNDLAND AND LABRADOR HYDRO

CONTRACT

FOR

DESIGN, SUPPLY, INSTALLATION AND TESTING OF A VHF MOBILE RADIO SYSTEM

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APPENDIX B

NLH User Survey Results

for

MRS Expansion Planning

CUSTOM
SYSTEMS
ELECTRONICS LIMITED

Prep. By: N. Cook, P.Eng.
Date: 2004 01 26

ATTACHMENT 12
Rev 2004 01 26

NLH MRS User Survey Summary

File:MRSSurvey.Summary

The original Survey, from which the results below are derived, comprises 37 responses. Each of 6 questions is repeated below for reader convenience, the % response indicates the % of 37 which responded as indicated to the respective question #:
The respondents represent the various areas of NLH operating areas, Bishops's Falls, Labrador, Bay d'Espoir, Deer Lake, Hind's Lake, Burin Peninsula, and the Northern Peninsula.

Question 1 Is the existing MRS meeting your safety and operational needs (i.e. radio physical limitations, etc.)? If not, please provide suggestions for improvement, or indicate existing features you do not use.

Question 2 Does your job require that you use your radio in adverse weather conditons? Please briefly describe weather conditions you have worked in, and whether a portable, mobile, or base station equipment is the equipment you use.

Question 3 Have you had difficulty accessing the MRS, which resulted in unsafe or inefficient job performance? If so, please describe below.

Question 4 If you could improve the MRS for safer or more efficient use of the MRS for your job performance, which features would you like to see? Please indicate your preference with a check '√' in front of response below; indicate whether feature is mandatory (M) or optional (O) where optional is desirable but depends largely on cost and is not necessary for immediate life safety or emergencies.

___ No additional features required;
___ More indication of call progress (I,e, busy, callback when channel available, etc.)
___ Roam between repeaters without having to change channels (i.e. similar to cell phone operation)
___ Transmit vehicle location with each push to talk (PTT) transmission.
___ Training in radio equipment, or system, operation.
___ Improved radio system coverage, or access; indicate area _____.
___ Voice message & mail for called radio user.
___ Call forwarding.
___ Radio out of coverage range indication.
___ Secure, or radio communincations privacy.

Question 5 Other, indicate 'M'. Or 'O' prior to feature _____.

Question 6 What other comments do you have which may not have been included in the above Q1 to Q5, above? Please comment below, using additional sheets as required. _____.

Survey Results - refer to Questions Sheet 1 of 2: **RESPONSE %**

Q1	Q2	Q3	Q4	Q5 & Q6
Meeting Needs? Yes = 24% NIL = 3 % No = 77 %	Weather Conditions? Non issue=16% NIL=3% All weather=81%	Existing Difficulties? Yes=76% NIL response=3% No=16%	Features Required? No new required=76% Call progress tones=43% Roam=76% AVL=54% Training=62% Coverage=82% Voice Message=49% Call Forward=43% Out of Range=70% Voice Privacy=57%	Other Requirements identified: Responded 81 %

RESPONSE DETAILS

Q1	Q2	Q3	Q4	Q5 & Q6
- 73 % require more coverage	- 81 % of respondents require radios in all weather conditions.	- The 76 % respondents reiterate coverage as the problem with the existing MRS.	- % reflect whether mandatory, or optional, requirement is indicated.	- Requirements for additional radio coverage in the following specified areas: - South Brook TS, Cat Arm, Southern Hr, Northern Peninsula. Bay d'Espoir & Burgeo Highway. Springdale, Glenwood, Farewell Head, NW Gander, TLs 204,231, 202,206 et.al.; Barachoix, Annieop. S. Labrador, Cartwright, Red Bay, St. Anthony/Roddickton, Cook'sHr Terra Nova Pk, Sop's Arm/Howley Connaigre Peninsula, Fogo, Burin Highway, Hermitage, SSD & WAV - Only 8% had experienced the need to have priority over WST voice traffic. - Equipment failures, radio accessory improvements, were the other comments received.

APPENDIX C

Summary of Economic Analysis

VHF Mobile Radio System Replacement

Study Discount Rate: 8.50%

Alternative 2
NLH only on new NLH MRS

Year	NLH Capital 100% Costs	NLH O&M 100% Costs	Total	CPW to 2005
2005			0	0
2006	7,183,900		7,183,900	6,621,106
2007		962,794	962,794	7,438,957
2008		979,087	979,087	8,205,492
2009		996,155	996,155	8,924,291
2010		1,012,447	1,012,447	9,597,615
2011		1,059,484	1,059,484	10,247,020
2012		1,078,138	1,078,138	10,856,088
2013		1,097,120	1,097,120	11,427,325
2014		1,116,436	1,116,436	11,963,080
2015		1,136,093	1,136,093	12,465,558
2016		1,157,009	1,157,009	12,937,197
2017		1,178,310	1,178,310	13,379,890
2018		1,200,004	1,200,004	13,795,414
2019		1,222,097	1,222,097	14,185,436
2020		1,244,596	1,244,596	14,551,521
2021		1,267,510	1,267,510	14,895,139

Alternative 3
NLH accommodated on expanded NP MRS

Year	NLH Capital Costs	NLH O&M Costs	Total	CPW to 2005
2005			0	0
2006	2,354,332		2,354,332	2,169,891
2007		887,229	887,229	2,923,552
2008		902,242	902,242	3,629,925
2009		917,971	917,971	4,292,309
2010		932,984	932,984	4,912,786
2011		949,411	949,411	5,494,723
2012		966,127	966,127	6,040,514
2013		983,137	983,137	6,552,403
2014		1,000,447	1,000,447	7,032,497
2015		1,018,061	1,018,061	7,482,771
2016		1,036,804	1,036,804	7,905,410
2017		1,055,893	1,055,893	8,302,111
2018		1,075,332	1,075,332	8,674,465
2019		1,095,130	1,095,130	9,023,966
2020		1,115,292	1,115,292	9,352,018
2021		1,135,825	1,135,825	9,659,937

Alternative 4
NLH and DTW on new NLH MRS

Year	NLH Capital 50% Costs	NLH O&M 50% Costs	Total	CPW to 2005
2005			0	0
2006	3,592,000		3,592,000	3,310,599
2007		481,397	481,397	3,719,525
2008		489,543	489,543	4,102,792
2009		498,077	498,077	4,462,192
2010		506,224	506,224	4,798,853
2011		529,742	529,742	5,123,556
2012		539,069	539,069	5,428,090
2013		548,560	548,560	5,713,709
2014		558,218	558,218	5,981,586
2015		568,046	568,046	6,232,825
2016		578,505	578,505	6,468,644
2017		589,155	589,155	6,689,991
2018		600,002	600,002	6,897,753
2019		611,048	611,048	7,092,764
2020		622,298	622,298	7,275,807
2021		633,755	633,755	7,447,616

Alternative 5
NP joins new Alternative 4 in 2008

Year	NLH Capital Costs	NLH O&M Costs	Total	CPW to 2005
2005			0	0
2006	3,592,000		3,592,000	3,310,599
2007		481,397	481,397	3,719,525
2008	(331,295)	489,543	158,248	3,843,418
2009	Note 1	451,298	451,298	4,169,063
2010		458,679	458,679	4,474,105
2011		476,803	476,803	4,766,359
2012		485,198	485,198	5,040,460
2013		493,741	493,741	5,297,536
2014		502,434	502,434	5,538,644
2015		511,280	511,280	5,764,775
2016		520,693	520,693	5,977,029
2017		530,279	530,279	6,176,255
2018		540,042	540,042	6,363,255
2019		549,984	549,984	6,538,778
2020		560,110	560,110	6,703,529
2021		570,422	570,422	6,858,168

Note 1: In 2008, NP contributes to Net Book Value of Original Capital and in 2009 contributions to O/M commence

Alternative 6
NP joins new Alternative 4 in 2009

Year	NLH Capital Costs	NLH O&M Costs	Total	CPW to 0
2005			0	0
2006	3,592,000		3,592,000	3,310,599
2007		481,397	481,397	3,719,525
2008		489,543	489,543	4,102,792
2009	(290,521)	498,077	207,557	4,252,559
2010	Note 2	458,679	458,679	4,557,602
2011		476,803	476,803	4,849,856
2012		485,198	485,198	5,123,957
2013		493,741	493,741	5,381,033
2014		502,434	502,434	5,622,140
2015		511,280	511,280	5,848,272
2016		520,693	520,693	6,060,525
2017		530,279	530,279	6,259,752
2018		540,042	540,042	6,446,752
2019		549,984	549,984	6,622,275
2020		560,110	560,110	6,787,025
2021		570,422	570,422	6,941,665

Note 2: In 2009, NP contributes to Net Book Value of Original Capital and in 2010 contributions to O/M

Alternative 7
NP joins new Alternative 4 in 2011

Year	NLH Capital Costs	NLH O&M Costs	Total	CPW to 0
2005			0	0
2006	3,592,000		3,592,000	3,310,599
2007		481,397	481,397	3,719,525
2008		489,543	489,543	4,102,792
2009		498,077	498,077	4,462,192
2010		506,224	506,224	4,798,853
2011	(204,183)	529,742	325,559	4,998,403
2012	Note 3	485,198	485,198	5,272,504
2013		493,741	493,741	5,529,580
2014		502,434	502,434	5,770,688
2015		511,280	511,280	5,996,819
2016		520,693	520,693	6,209,073
2017		530,279	530,279	6,408,299
2018		540,042	540,042	6,595,299
2019		549,984	549,984	6,770,822
2020		560,110	560,110	6,935,573
2021		570,422	570,422	7,090,212

Note 3: In 2011, NP contributes to Net Book Value of Original Capital and in 2012 contributions to O/M commence

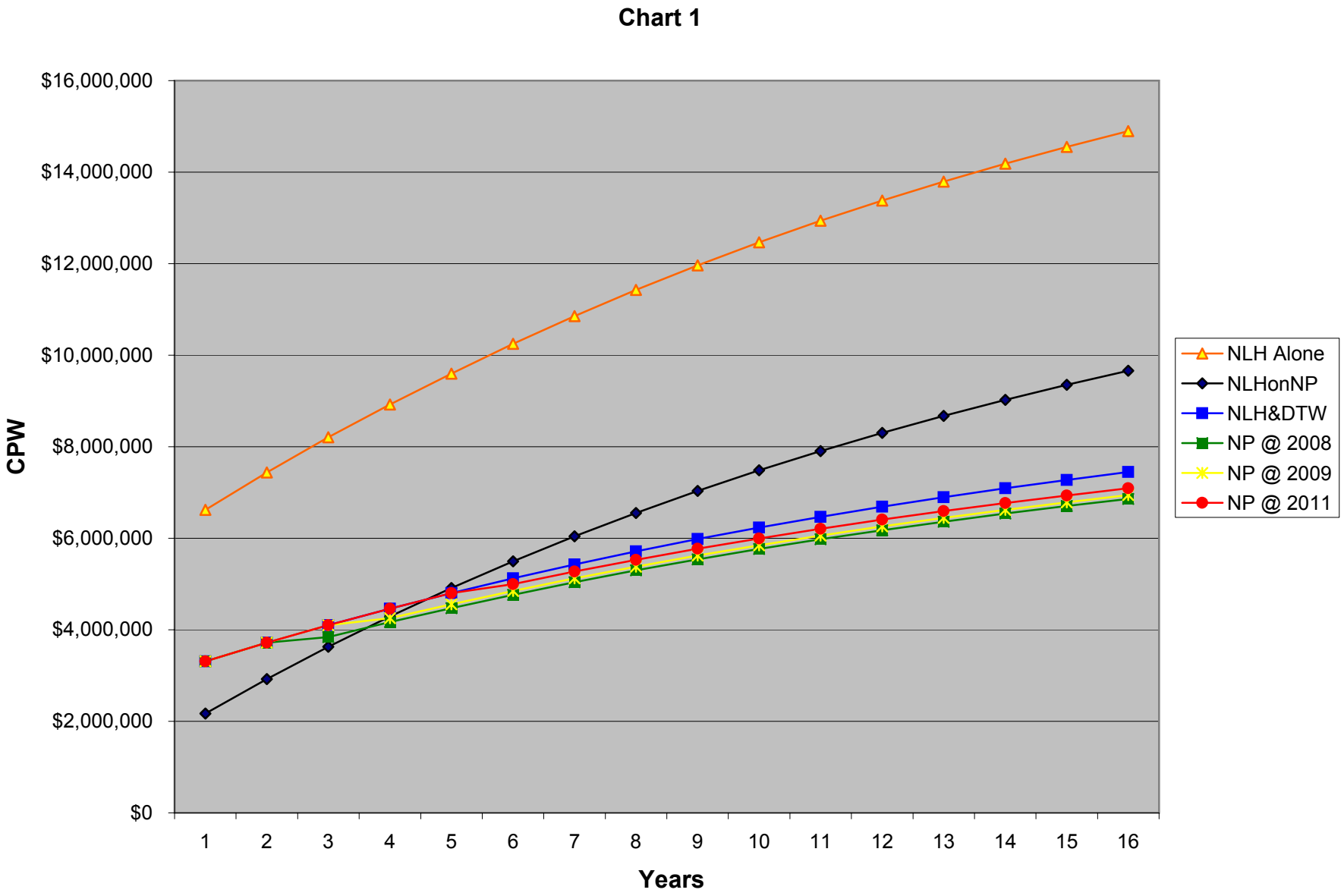
Chart 1
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
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CPW
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Years
NLH Alone
NLHonNP
NLH&DTW
NP @ 2008
NP @ 2009
NP @ 2011