An Overview of Hydro's Telecommunications Plan

July 7, 2003

Hydro's Communications Requirements

- Teleprotection -Power System Protection Signalling
- Data communications between the terminal stations, generating stations and the Energy Control Centre that support the remote control & operation in support of the Energy Management System (EMS) – SCADA.
- Operational Voice -Telephone between the terminal & generating stations and the ECC.
- Operational Data - Monitoring of alarm systems
- Administrative Voice -Telephone for general admin
- Administrative Data - for e-mail, access to JDE etc.

Communications Systems Used by Hydro

- Microwave
- Power Line Carrier (PLC) – High Voltage
- VHF Mobile Radio
- Satellite
- Fibre Optic Cable
- Wide Area Network
- Common Carrier Facilities

Microwave Communications System

- Point to point communications system operating between 1 GHZ and 30 GHZ. 7 GHZ is specified for the utility sector.
- Involves sending waves of information between a transmitter and a receiver, each mounted on a tower.
- Provides a medium capacity backhaul/transfer system.
- Requires clear “line of sight”.
- Microwave can not be used for mobile communications

Microwave Communications System - Functionality

- Teleprotection
- SCADA
- Operational & Administrative Voice
- Operational & Administrative Data
- Forms the backbone communications infrastructure
- Common in the utility environment

Power Line Carrier - Characteristics

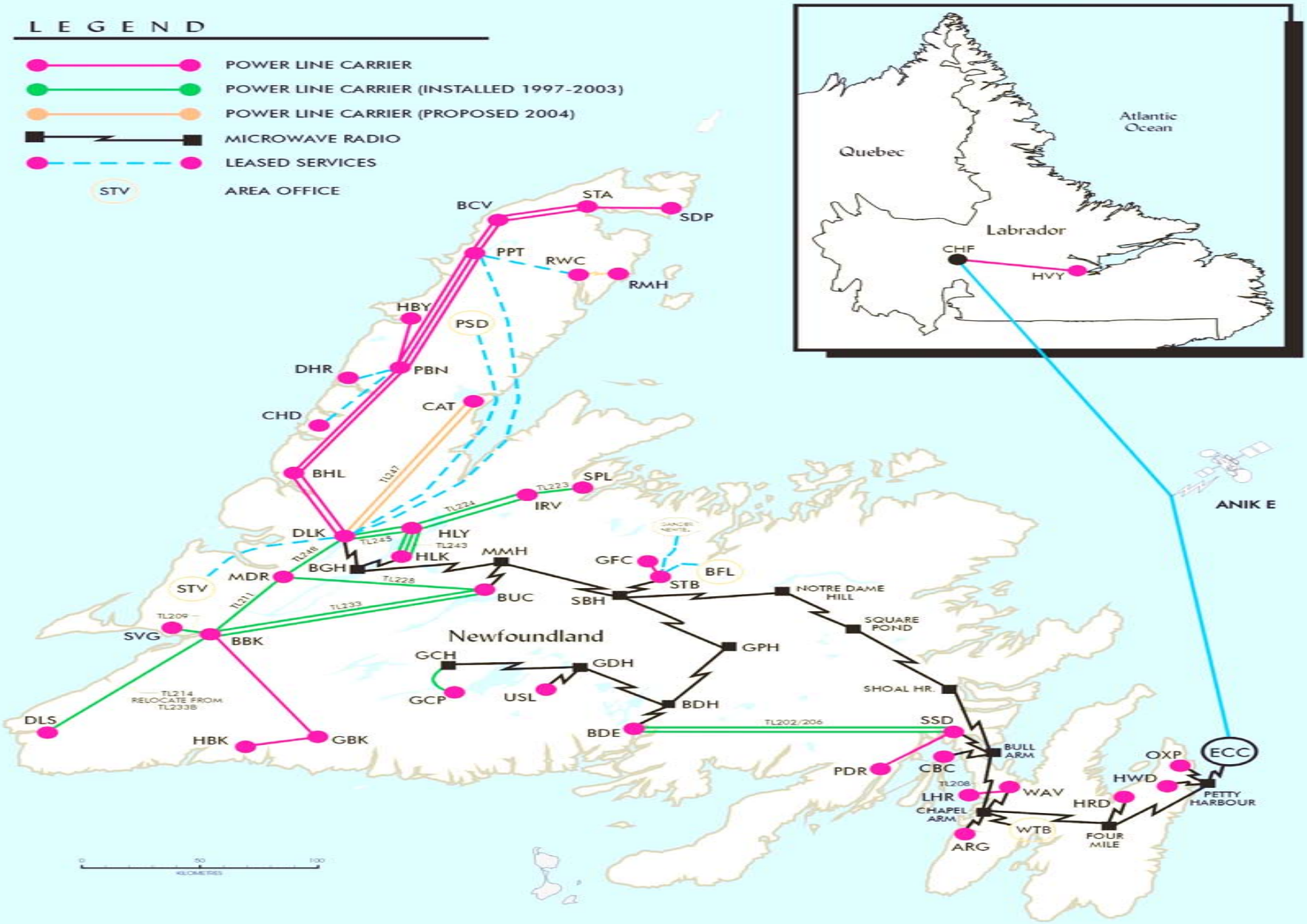
- Based on 1940's technology and is a point to point communications system that is directly coupled to the high voltage transmission lines (230 KV & 138 KV)
- Involves sending waves of information between a transmitter at one terminal station and a receiver at an adjacent station

Power Line Carrier - Characteristics

- Provides a low speed and low capacity transfer system
- State of the art is digital technology (56 kbps) 1 – voice circuit
- Performance is affected by:
  - Power line disturbances (faults & lightning strikes)
  - Some line maintenance activities
  - Icing
- PLC can not be used for mobile communications

Power Line Carrier (PLC)- Functionality

- Teleprotection
- SCADA
- Operational Voice
- Operational Data
- Common in the utility environment



Proposed Telecommunication Plan

Mobile Communications System

- Required for voice communications between personnel performing switching operations, maintenance & emergency repairs – mobile to a fixed location, mobile to mobile
- One to One or One to Many
- Operating frequencies (VHF, UHF, 800 MHZ)
- The ideal path is obstruction free
- The limiting factor is generally mobile transmitter talk back range.

Classes of Service – Mobile Radio Systems

- Public Safety – Police – RCMP/RNC, Ambulance, Civil Defense, Fire, Rescue
- Public Service – Power Utilities – Newfoundland Power, Forestry – Kruger & Abitibi woods operations, Manufacturing – N.A.R.L.
- Private Individuals

Characteristics of Mobile Communications Frequency Bands

	Frequency Band (MHz)			
	150-170 (VHF)	450-512 (UHF)	806-866	900 + (Cell & Satellite)
General Use	Rural & Suburban	Suburban & City	City	City
Terrain/Bldg. Losses	Medium	High	Higher	Highest
Penetration into buildings	Average	Good	Better	Best
Foliage Losses	Medium	High	Higher	Highest
Transmission Line Losses	Average	High	Higher	Highest
Multi-path Effect	Noticeable	Pronounced	Very Pronounced	Very Pronounced

Typical Ranges Obtained in the Mobile Frequency Bands

	Frequency Band (MHz)				
	150-170 (VHF)	450-512 (UHF)	806-866	Cell	Satellite
Range (miles)					
Base to Mobile	40	30	20	< 20	unlimited
Mobile to Base	30	20	15	< 15	unlimited
Mobile to Mobile	10	7	5	N/A	N/A

Note: Ranges shown are approximate and do not take into consideration terrain, building and foliage losses or high ambient noise environments.

Mobile Communication Systems for Power Utilities

- Power utilities rely on effective wireless communications systems for switching, live line, troubleshooting, emergency repairs & general maintenance work.
- When these systems do not work, life & property will be endangered.

MOBILE RADIO SURVEY - DECEMBER 2001

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

NR - No Response

Questions:

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

Notes:

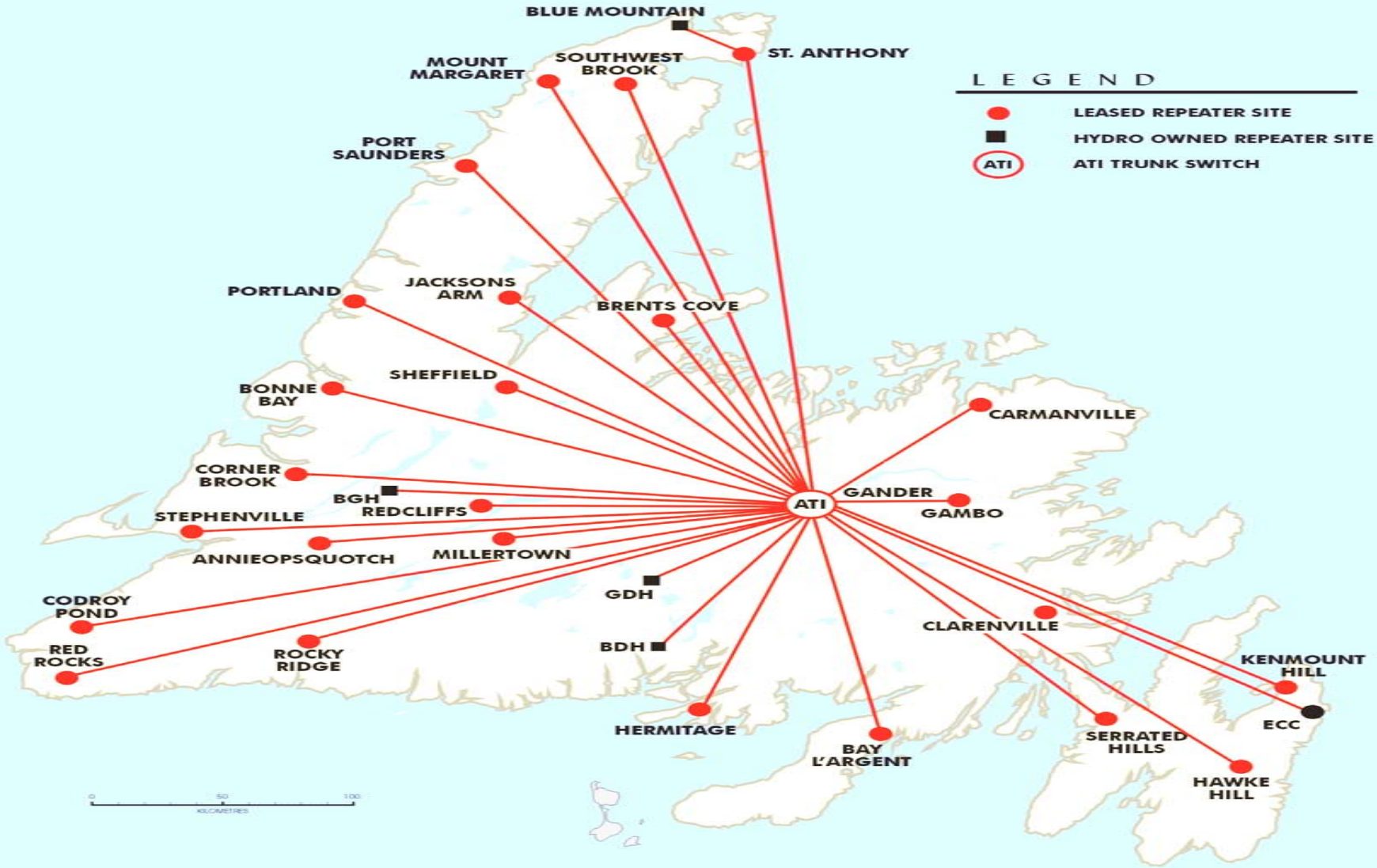
1. Only if we (ATCO) had priority (last off, first on) and the service could be shown as reliable and economic as our own, and the right penalty clauses were in place.
2. 2. All utilities using cellular or satellite phone do so to complement the coverage of the Mobile Radio System.

Hydro's VHF Mobile Communications System

- Mandatory communications link between field and ECC personnel.
- Communications link between work crews and/or area offices.
- Paging & on call requirements.
- General communications link between fleet vehicles.
- WS&T Road Maintenance Crews.

Existing VHF System

- Manufactured by ATI & placed in service in 1989
- A single central switch with 29 repeaters; 26 Aliant sites,3 Hydro sites
- Single Channel System – 150Mhz, 25Khz channels
- Provides Public Switched Telephone Network access
- Paging Capable from ECC
- Switch & repeater equipment is maintained by Aliant
- Hydro has 275 mobiles & 75 portables
- WS&T has 350 mobiles



Existing VHF Mobile Communications System

Existing VHF System Technology Issues

- One of only 4 systems placed in service by ATI prior to their exit from the business in 1991
- Site controller & central switch are a proprietary design
- Inadequate spares to maintain central switch & site controllers.
- Unable to secure additional spares since 1997.

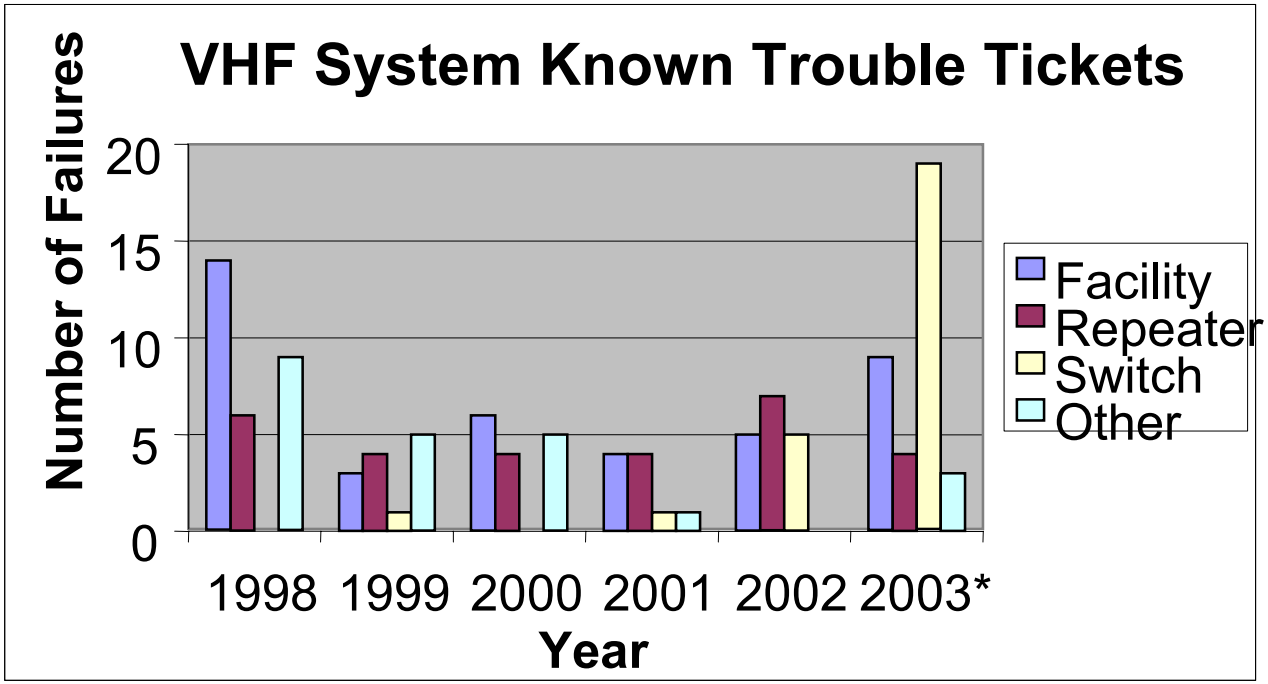
Existing VHF System – Technology Issues

- Motorola Repeater Equipment Manufacturer Discontinued in 1996 – limited repair support
- Only spare repeater has been placed in service – scavenging parts from de-commissioned unit
- Increasing failure rate of power supplies – no replacement available
- Motorola Radios – Manufacturer Discontinued – most units unable to be repaired

Existing VHF System – Technology Issues

- Failure rate of central switch & repeaters – increasing
  - Switch card cage is not reliable.

* 2003 represents two months (January and February)



Existing VHF System – Business Issues & Concerns

- Maintenance of VHF system is by Aliant - No trained staff remaining knowledgeable about switch.
- System expansion is not possible to support existing additional coverage requirements - Granite Canal, Happy Valley, Southern Labrador, & Great Northern Peninsula.
- Lack of ability to increase coverage affecting ability to do work.
- Switch failures extending outages.
- System failure will greatly impede ability to do work (increased restoration times).
- Replacement time after complete or partial failure of 18-24 months is not acceptable in terms of customer service & the safety of personnel .

Summary: The anticipated life of information technology is determined by three factors:

- **Physical obsolescence** occurs when equipment is damaged or worn beyond repair. **This is the case for the VHF system.**
- **Functional obsolescence** occurs when equipment, although working, no longer provides useful service under current conditions. **This is not the case for the VHF system.**
- **Technical obsolescence** occurs when equipment can no longer be maintained or upgraded because regulations, industry standards, manufacturing priorities no longer support it. **This is the case for the VHF system.**

Proposed System

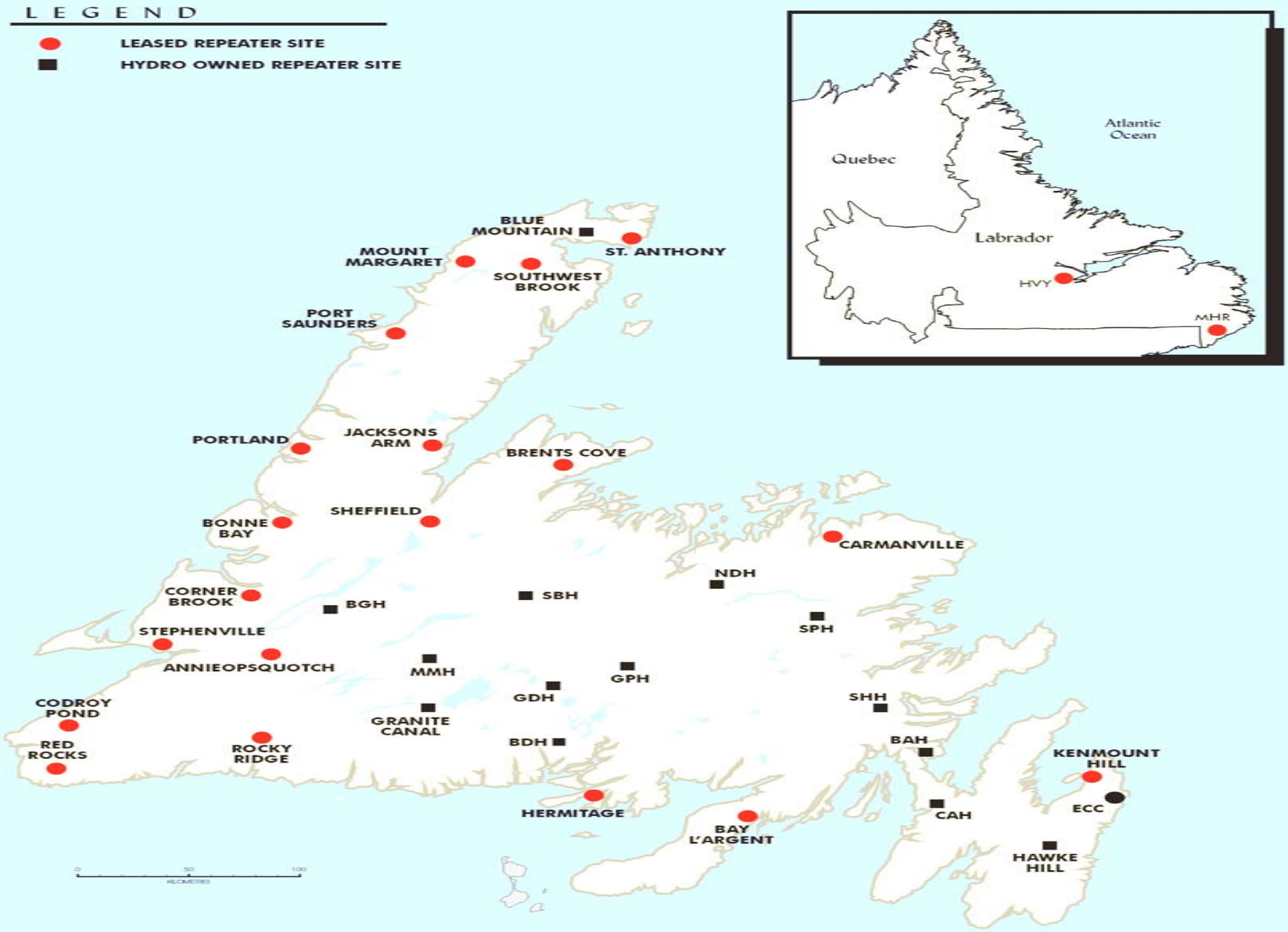
- VHF Mobile Communications System
  - Satellite & cell phone technologies are not suitable because of functionality and coverage reasons.
- Support coverage requirements (estimate 35 sites) plus expandable for future needs.
  - Move from Aliant sites where appropriate to improve coverage & decrease operating costs. No new sites are planned.

Proposed VHF Communications System

- Radio access will be expanded to meet Hydro's existing requirements plus expandable to meet future needs.
- System will be designed to meet Industry Canada's new channel requirements of 12.5 Khz.
- Trunked Design – more efficient for future channel requirements.
- There are different types of trunked mobile radio systems.
  - E.g.. distributed architecture (Passport) versus central switch.
  - Final decision by Hydro will be made upon Tender evaluation.
  - Costs of the various trunked mobile radio systems for a Public Service System are approximately the same.

Proposed VHF Mobile Communications System

- Support 625 mobiles & 75 portables.
- Allows integration of Hydro's mountain top repeaters between Churchill Falls & Happy Valley (future).
- Able to support data (future).



Proposed VHF Mobile Communications System

Proposed VHF Mobile Communications System

- Hydro has unsuccessfully pursued shared/joint build/leased options for VHF mobile communications system with Aliant & RCMP/RNC.
  - Hydro is not committed to an own only mobile communications infrastructure
- Proposing a shared cost agreement between Hydro & WS&T
  - Capital & operating costs to be shared.
  - WS&T coverage requirements over and above Hydro's will be at WS&T's expense.
  - Any cost recovery from WS&T of capital and/or operating contributions will result in a reduction of Hydro's revenue requirement.
- Expandable to accommodate NP when & if it is a viable alternative for NP.

Summary of Proposed Alternatives

- A complete replacement of the existing infrastructure is the least cost option.
- Additional functionality offered by the trunk alternative outweighs the small incremental cost over the conventional alternative.
- Currently a leasing option does not exist.

Summary of Proposed Alternatives

- There is no cost advantage to do a phased implementation of the proposed system.