

Communication Consulting Service

16 Alling Drive. Gray, Maine 04039 Tel. 207-657-4009 Cell 207-831-3708

Attached are my findings upon examination of the town of Boxborough public safety communication systems. The goal of this report is to guide the town in their process to replace the ageing radio network. There is an abundant supply of new technology available today. We now have radios that are computer programmable and support over one thousand channels, compared to four channels that required a custom cut crystal to generate the proper transmit and receive frequency. We have microwave radios that today cost a fraction of the price and have much improved performance.

The one thing that has not changed is the physics of radio propagation, and an argument could be made that propagation has gotten worse as the amount of radio spectrum declines due to ever expanding use.

The public's perception of radio today is one of being able to talk anywhere anytime with nothing more than a simple earpiece. Since the 2013 FCC requirement that public safety users reduce their spectrum use by 50% (narrowband) radio coverage has suffered. I have numerous customers that constantly ask why we can't communicate like we see on television. Although this type of communication is available, what is not shown is the billions of dollars in infrastructure that makes this possible.

Findings:

The town of Boxborough's communication system consists of three separately installed systems operating on different bands. The Police Department utilizes a VHF repeater with a single remote receiver. The Fire Department operates on a mixture of UHF and LOW band with a cross band repeater. The DPW operates on Low Band with direct unit to unit communications.

There is limited interoperability between town departments. The Fire and DPW may be able to communicate but there is no communication between the Police department and both Fire and the DPW.

Police Department Infrastructure:

The Police Department radio system operates on VHF High Band on a frequency of 154.6475 MHz this current system was installed in 2001. A repeater located at 85 Swanson Road acts as the only transmitter site and one of two receiver sites. The second receiver is located at the Hager cell tower. Both receivers are connected to a comparator voter located at the dispatch center connected via lease telephone lines. The radio equipment used in this configuration is a mixture of a Motorola repeater, GE master two remote receivers, Ericsson voter and a GE keying panel. It is generally recommended that all receivers in a voter system be the same make and model due to audio and timing difference between brands. Most of this equipment has reached the end of its useful life expectancy, and in one case, the department had to buy parts on E-bay to keep the system operational.

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These lines are a constant source of trouble. The day I was on site I had an opportunity to listen to radio traffic on the Police channel. It was horrendous. I could barely make out what the officer was saying. When I switched my radio to the mobile transmit frequency, bypassing the radio repeater system, I could hear the officer quite clearly. The phone lines are introducing terrible amounts of distortion, hum and high frequency roll off into the radio system. Additionally, the old copper phone lines have become quite un-reliable and are the source of chronic outages. Most telephone companies are not maintaining these lines any longer. The telephone companies' ability to make them perform as designed is limited. The personnel and equipment required to maintain these lines is dwindling fast with the advent of digital and fiber optics lines.

The Police Department has coverage issues in the north east part of town along with, in building coverage in numerous areas. This obviously is a very serious condition and it presents a serious safety issue for the officers. This department needs an infrastructure upgrade.

Police Department Mobiles and Portable Radios:

This department uses Motorola XTS1500 portables and Motorola MCS2000 and XTL2500 mobiles. These are both current products and supported by Motorola. Both are excellent products for this application. No changes to this equipment are recommended.

Fire Department Infrastructure:

The Fire Department has a single cross band UHF/LOW band repeater at the Hagar cell site operating on 46.5 MHz and 471.600 MHz the Fire Department also has a backup low band transmitter at the 85 Swanson Road cell site connected by a phone line to dispatch. This arrangement using a cross band repeater allows the Fire Department to use UHF portables and communicate over the low Band fire channel. Both the repeater and the base station are based on mobile radios. The Swanson Road base station has an additional 100 watt amplifier tied to it. The use of mobile radios as base stations is not recommend practice especially for public safety applications. (See note 1) The Fire Department is also suffering with the same phone line issues and coverage issues as the Police Department. In building portable coverage is a major concern to the Fire Department as they depend on using their Vehicle repeaters system on a fire ground, especially during the first few minutes of a response when limited personnel are on scene. This department needs an infrastructure upgrade.

Fire Department Mobiles and Portable Radios:

This department uses Motorola HT1250 Portables and Motorola CDM1250 mobiles. These are both current products and supported by Motorola. Both are excellent products for this application. No changes to this equipment are recommended.

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Department of Public Works:

This department has the simplest of radio systems, operating on a low band simplex channel of 46.58 MHz. There is a mobile radio at the garage that is used as a base station connected to a Ringo Ranger antenna that appears in poor condition. (see note 1)

Department of Public Works Mobile Radios:

This department has mostly Motorola CDM750 radios in their trucks with a couple of Vertex and Kenwood mobiles as well. They also suffer from coverage issues within the town and they are not able to talk to the Police Department directly. This department needs an infrastructure and mobile and portable radio upgrade.

Dispatch-Console:

The Dispatch console is the heart of any dispatch center. The console is connected to multiple radios in the field and is the means for the dispatchers to have a single communications device that will communicate with multiple radios on multiple frequencies.

The dispatch center runs two different models of consoles (highly unusual) for its two dispatch positions. The Motorola Comtegra is used at the second position with a Motorola Command lite at the primary dispatch position. Having two independent consoles connected to the same termination points can be problematic if not configured correctly. This can result in impedance loading and level problems on the circuits it is connected to.

The consoles are not interconnected operationally to each other as they are different models. In a normal two or more position system, the consoles work together so that each dispatcher knows the status of the other console. For example, when one dispatcher is talking on the police channel, the other dispatcher console will indicate the police channel in use. This prevents communication crashes when two dispatchers try to talk on the same channel at the same time.

The physical layout of the dispatch center located within the Police Department building is large enough to support two dispatchers at one time, any more and it would be a bit cramped. It has good light and is quite secure due to its location. It does have some vulnerability being alongside Massachusetts ave. A vehicle that goes off the road, either accidental or intentional, could hit the dispatch center and make it inoperable. Maybe a guard rail on the street would be in order to help minimize this risk.

Wireline:

The Verizon phone lines are a major source of ongoing trouble to the Police and Fire Departments. The departments experience extremely poor audio quality and reliability with these lines. Phone companies today have very limited resources in maintaining these types of lines as they are not very common any longer. Phone companies have migrated over to digital and fiber optics and in many cases no longer have the personnel to maintain these analog circuits or lines.

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Voter:

The voter is a two channel unit built by Erricson. This was installed in the system upgrade of 2001. It is no longer a current unit and support no longer exists.

A comparator voter takes the receive signal from one of more receivers located within the desired coverage area and compares them to each other. It then selects the best quality signal and forwards it to either a repeater or the dispatch console.

Licensing:

There are numerous FCC licensing issue within the town that need to be addressed ASAP.

Frequency bands:

Low Band (LB): 30-50 MHz Long range poor building penetration

Very High Frequency (VHF): 147-174 MHz Shorter range, good building penetration compared to Low band

Ultra High Frequency (UHF):450-512 MHz Shorter range, excellent building penetration compared to VHF

In Conclusion,

It is my professional opinion that all departments need an upgrade to their communication systems.

Recommendations:

Based on the needs assessment and talking with town officials, A new radio system should be built for the three town agencies. A voting simulcast repeater system located on three sites would be recommended for the Police and Fire Departments with a new site developed on Middle Road, the highest point in town. I would further recommend that the Department of Public Works get licensed on VHF high band and reuse the existing Police Departments repeaters that are still in good working order but not suitable for simulcast radio systems. In addition, a new dispatch console is required to improve the reliability of the radio system infrastructure.