Town of New Milford, Connecticut

Communications Center Project
and
Radio System Needs Assessment

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Submitted to:
Communications Committee
Town of New Milford
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Executive Summary

The Town of New Milford has identified deficiencies with their current dispatch center/public safety answering point (PSAP). Its equipment is in need of replacement, and the room that it is located in is not large enough for the task. The Town has also identified deficiencies in the Town radio systems used by public safety agencies. The system provides insufficient coverage throughout the Town, as well as in buildings, and the channels in use are inefficiently utilized.

The Communications Committee has requested a review of the needs of the users within the Town: Dispatchers, Police, Fire, and Ambulance; a comparison of those needs with the capabilities of the existing communications center equipment and the radio system; and a plan for changes to the system to meet the expressed needs of the various departments.

This report identifies solutions for the construction of a replacement dispatch center, to be relocated to the training room; and identifies solutions to the radio coverage problems; and suggests further courses of action for the Town to take.

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1. Overview

Oliver Associates has been retained by the Town of New Milford to assist in the planning and implementation of an upgraded 9-1-1 Communications Center and radio system for the Town.

The Communications Center in the Police department utilizes an eighteen-year-old Motorola Centracom radio console. This is a two-position operation, staffed with two Telecommunicators around the clock, which handles 9-1-1 PSAP duties and dispatches Police, Fire and EMS. There is a third telecommunicator/supervisor position staffed, who is available for overflow and substitute staffing when on duty.

However, there is no spare console for overflow during peak periods, except for a side room with only a telephone and no radio equipment. There is no spare console position for training, or to allow routine maintenance or emergency repairs to be performed without impacting normal service delivery.

As a result, the Town has come to the conclusion that the existing Communications Center space needs to be renovated and expanded in order to increase reliability, reduce maintenance costs, and improve service delivery by the Telecommunicators.

At the direction of the Communications Center/Radio Committee, we have also included an evaluation of the radio systems currently in use by the Town's Fire, EMS and Police Departments. The Town has identified deficiencies with their current radio system, which uses High Band VHF (150 MHz) frequencies for its operation. The committee is concerned that the existing system provides insufficient coverage within the Town, and has requested a review of the radio communications needs of the Police, Fire, and EMS users within the Town; the Committee desires a comparison of the capabilities of the existing radio system to a plan for a new system that meets the expressed needs of the various departments.

After meetings with the Communications Center/Radio Committee, interviews with the Telecommunicators, and meetings with officers and members of the Police Department; the Northville, Waterwitch #2, and Gaylordsville Volunteer Fire Departments; and New Milford Community Ambulance; as well as Mike Zarba (DPW) and Thomas Sprong (Town Engineer), we offer the following determinations and recommendations.

2. Communications Center Findings

A) The Town has requested a long-term solution for the Communications Center. Our evaluations included considerations for future requirements out to 20 years, encompassing the physical elements that make up a successful 9-1-1 communications center, including: space, power, security, dispatcher comfort, HVAC, furniture, lighting, radio console equipment, resiliency and backup, overflow capability, and disaster recovery

B) The Police building houses both the 9-1-1 PSAP and the EOC. Both these capabilities will be retained "in house" after the renovation is complete

C) The Police building and its communications center have had problems in the past with grounding and lightning. The replacement equipment must be protected from lightning and surge damage. NFPA #1221 and Motorola R56 will be used to benchmark the electrical surge protection plans.

D) The Town wishes to have the renovated communications center meet all applicable codes and standards, including ADA access and use.

E) Two dispatch positions are insufficient. The Town wants the design to be a three-position dispatch center, with expansion possibilities for a fourth position.

F) Existing security monitoring features (video monitors, door and cell controls), as well as additions and enhancements must be provided for in the renovated center.

G) Items that will not require upgrading/replacing include:

1) Logging Recorder

2) CAD / Records Management System

H) The TCs will need to continue to interact with the public. This requires some type of window with a pass-through available when needed. The current design must be improved upon

I) The original plans to expand the existing dispatch center into the lobby area are not practical, for the following reasons.

1) The dispatch wall facing the lobby is a bearing wall. It will be expensive, untidy and time-consuming to replace it. The work will disrupt the normal operation of the existing communications center and has the potential to create an unhealthy work environment for the Telecommunicators and damage existing equipment.

2) It will require two moves of the dispatch center: first, to a temporary location while the gutting and renovation takes place; and next back to the original (now expanded) dispatch location.

3) After "suffering through" the expense, inconvenience and mess of (a) and (b) above, the space gained will be only marginally adequate for a three-position center.

J) The logical place for the renovated dispatch center would be the training room. The advantages of this location include:

1) Allows construction of the new center with no interruption to current dispatch center operations.

2) The operations room space (14' x 25') is sufficient to provide a three-position dispatch center, with a break area and a lavatory located within additional secured space taken from the south side of the lobby. The break area thus created will be separated sufficiently to offer a respite from work, while being close enough to keep the telecommunicators immediately retrievable. Four positions will not fit in the space allocated for the new communications area, partially due to the swing required for the doors to Rooms 222B, C and D, unless the wall is pushed back towards the West, creating a dispatch area of 16' x 25', leaving the EOC with a width of approximately 10'.

3) The EOC will gain a secure space immediately adjacent to the dispatch center (but separated by a secure wall). The EOC will have access to the Communications Center when required, but will also have its own, separate outside access.

4) Changes to the lobby would reclaim space that would be added to Room #237. This will create a 10' x 20' public meeting room accessed from the lobby, which is unsecured and thus available for both department training and citizen use. This preserves the EOC for emergency use only, increasing security for this function. The current Police occupants of #237 would be relocated to the vacated dispatch area.

5) Window access to the telecommunicators will be possible without the window having a view of the actual dispatch area, maintaining required security for the data systems within the center.

6) A small portion of the training room (the West end) overlaps the basement, with the remainder constructed as slab-on-grade. Compared to the expand-in-place alternative described above, this location has easy access to utilities in the basement and sufficient space available outside the wall for ground placement of the required new HVAC equipment. In addition, space may be available within the secure area for co-location of the console supporting electronic equipment, which is currently located in the basement level.

K) The backup generator appears to be correctly sized for the application. It is located in the basement of the building, near the northwest wall.

3. Radio System Findings

A) Fire Departments

The Fire Departments use VHF High Band for paging, dispatch, and tactical communications. The three departments, Waterwitch #2 (WW), Northville (NV) and Gaylordsville (GL) utilize multiple frequencies and base station configurations in Low Band as well as VHF High Band. WW and NV use a VHF high band repeater system for dispatch and paging as well as most tactical communications. It has two transmit sites, with the main site on Geiger Road, and the backup site at NMPD. There are two additional receive-only sites, located at the Lanesville and Gaylordsville Fire houses.

A separate, non-repeated VHF High Band (simplex) frequency is used for paging, dispatch, and tactical communications for Gaylordsville. The single site is behind the Gaylordsville fire house. The Gaylordsville system provides coverage in the Northwest part of Town, but has no associated "voter" receivers, so portable radio coverage fails as users move into the center of New Milford.

The two systems are controlled from the New Milford Police Department Public Safety Answering Point (NMPD PSAP). The telecommunicators can select one, or both of the channels to transmit on, but they are not automatically selected.

Neither system provides the desired coverage, which is on-hip, in-building coverage, Town wide. Portable coverage is very poor in the North-center portion of the Town, especially alongside the northern Town border, as well as in Gaylordsville. Telecommunicators and firefighters alike must manually change their radios to/from Gaylordsville to New Milford in order to continue communicating.

B) New Milford Community Ambulance:

The Ambulance utilizes a single site VHF High Band frequency for paging, dispatch, and tactical communications, which is controlled from both the NMPD PSAP, and from New Milford Hospital. There are no voting receivers, and the base station/antenna is located in/on the garage located at 100 Dorwin Hill Road. Portable radio coverage on this system is completely inadequate.

C) New Milford Police:

The Police Department uses a VHF high band repeater system for dispatch and tactical communications. The main base station is located at NMPD, and the backup repeater is located on a power pole on Chapin Road. There are five additional receive-only sites, located at the Gaylordsville and Lanesville Fire houses, the Webster Bank downtown, Sara Noble Intermediate School, and New Milford High School.

The system does not provide the desired coverage, which is on-hip, in-building coverage, Town wide. Portable coverage – and in some cases, mobile coverage – is very poor in some locations, especially in Gaylordsville.

D) Department of Public Works:

DPW has been included in this study from the perspective of providing interoperability between DPW users and Emergency Service workers. The DPW uses a Low Band simplex VHF system, at a single site on Geiger Road. The radios used by DPW do not have the ability to communicate directly with PD, FD, or EMS.

E) Terrain Issues

The land encompassed within the Town boundaries of New Milford is not ideal for radio coverage. Radio waves tend to propagate in straight lines, much as light does, but because New Milford has such varied terrain, with abrupt elevation changes, long ridges and deep valleys, the task of providing solid radio coverage to meet the needs of the public safety user is made much more difficult.

F) Low Band Coverage

The remaining VHF low band radio system equipment and licensed frequencies, as well as the equipment and frequency now in use by DPW, is much more forgiving in this type of terrain, but low band has other, serious flaws which make it a poor choice for public safety use by the Town.

The most serious of these is the inability to secure a clear channel, because the limited number of frequencies available for licensing on low band are shared, over and over again, with countless other public safety agencies throughout the country. This is a drawback because of a phenomena known as "skip", which often causes radio waves from hundreds and even thousands of miles away to be reflected off the ionosphere, and interfere with local communications when they arrive here. Such "skip" transmissions are often stronger at the base station than the desired local mobile signals, and when this occurs, the local mobiles are simply unable to be heard at the base station.

The second flaw arises due to the very poor performance of low band portable radios within buildings. Because of the electrical characteristics of the radio wave at low band frequencies, such radio waves suffer very high attenuation when transmissions into and out of buildings are attempted.

G) High Band Coverage

Higher frequencies, such as the VHF 150 MHz ("High Band") frequencies under study here, are affected to a lesser degree by building attenuation.

These frequencies are generally free of "skip" interference, and have the additional advantage that practical, efficient antennas are much shorter than their low band counterparts. However, VHF high band frequencies differ from low band frequencies in another, crucial aspect: they have much shorter range. As the Fire users in New Milford

discovered after the change-over to high band, as frequencies are increased, all other things being equal, the range available for a certain power level is lower; and the requirement for a 'line of sight' between the field user's radio and the base station becomes much more important.

H) Standards of Coverage and Engineering Factors

The ability (or lack thereof) to talk on the radio is not legislated – it is not a requirement of any statute that a particular level of coverage be provided for employees who use radios. It is a combination of an engineering decision, based upon what seems to be possible in a particular set of circumstances, that, along with political decisions regarding the level of funding that is available, determine how much — and where — radio infrastructure is installed.

"Radio is not 100%." This statement is often quoted in public safety circles, when employees ask why their radio did not work in some particular location. Regardless of the amount of money spent by a municipality on a radio system, there will always be places within the system where radios will not work.

Radio system engineering is, in actuality, a process of determining communication probability. Based upon distance, terrain and the type of vegetation and structures on the land, we can determine a "book value" for the signal loss to a particular location. However, the strength of a received signal varies with small changes in the mobile location. In a small area, 50% of the signals will arrive above the value we predict, and 50% will arrive below that value. The variations in signal in a small area have a Gaussian distribution, and when expressed in decibels, the distribution is log normal – it looks like a bell curve. Because of this variation, we need to calculate the standard deviation from the mean. For example, with the rolling terrain found in New Milford, the standard deviation at VHF frequencies is 6.75 decibels, or "dB." This number is considered a loss, and is added to the signal budget, which already contains our book value.

Many commercial land mobile radio systems are designed for 90% probability. That is, the radio will work as predicted 90% of the time. In municipal applications, where Towns or Cities are paying the cost and are not interested in coverage very much beyond their borders, we will often see requirements of 90% probability in 90% of locations within the contracted coverage area, or "90%-90% coverage." 90% probability requires a factor of 1.3 to be multiplied against the standard deviation (in our case, 6.75 x 1.3, or 8.76). Thus, 8.76 dB of margin must be added to the book loss values in order to reach the 90% percentile.

The failure of communications for public safety users can have a serious impact on safety of life, and for that reason, public safety agencies normally require the defacto standard of 95%-95% coverage or better (95% probability in 95% of the coverage area). This higher level of coverage requires a factor of 1.64 to be multiplied against the standard deviation. In New Milford's case, in order to achieve 95%-95%, 11 dB of margin must be added to the book loss values.

These numbers are not trivial. Simply going from 90% to 95% reliability 'costs' 2.24 dB, which represents almost a doubling of the output power. Because the licenses New Milford has have power and height limits (in order to protect other distant users of the shared frequencies), we will not be allowed to simply 'turn up the power' or raise the antenna height until mobile units are able to hear clearly in all parts of Town. All of the propagation analysis reports attached were done at the 95%-95% public safety coverage standard. It is for this reason that multiple transmit sites are often required in order to achieve the necessary coverage.

It should also be apparent from this discussion that a contractual requirement of 99% or more would be extraordinarily difficult (and expensive!) to achieve. The factor for 99% is 2.3, taking the New Milford margin figure to 15.53 dB. 99.9% has a factor of 3.73, for a New Milford margin of 25.2 dB! It is doubtful that New Milford could achieve that coverage; regardless of the amount of money the Town was willing to spend.

I) Portable Radio Issues

Another factor in coverage evaluation are the portable radios carried by our users. Because of the current state of battery technology (and also because of health and safety concerns), portable radio output power levels will not be higher than the current 5 – 6 watts. Higher power levels would require much heavier batteries, and as the previous example showed, it takes an enormous power change to make any difference at all. Therefore, increasing portable radio power output is not a practical option.

Providing adequate coverage outbound to the portable radio user is also very difficult. For systems of this type, the most difficult design consideration and the one item that will drive cost more than any other is the need to reach portable radios that are worn at the hip. Receive losses are very high in that environment, because of antenna system de-tuning and signal absorption caused by proximity to the body. If a system can be designed to provide adequate talk-out to such portables throughout the service area, mobile radio coverage will take care of itself.

Portable radio talk-in coverage is more complicated to calculate that talk-out coverage, because of the variety of ways a portable can be used. If the portable is removed from the holster to talk back, some of the losses included in the attached charts are no longer a factor. Talk back coverage would still be difficult, due to the low output power of the portables compared to the base stations and the attenuation of the signal by buildings; however, these problems are more simply and easily dealt with, through the use of strategically located voting receivers. If, however, the Town desires remote speaker/microphones to be available for the users, as is the case in New Milford, the proximity-to-body losses are still present, and talk-in coverage will become the critical factor in system design. Another factor driving system design is the Town's requirement to have the ability to receive automated emergency (distress) messages from the portables. Since these portables are likely to still be in the on-hip position when the emergency signal is activated, the coverage requirements will then be the same as for the speaker/microphone scenario.

J) How Coverage Is Determined

A computerized terrain analysis radio coverage program was used to generate coverage prediction charts for each of the proposed configurations discussed in this report. This software utilizes a 3-second terrain database which includes terrain coverage information, such as ground cover, vegetation type, and, for built-up areas, structure type; all of which are used in the calculation of the attenuation suffered by the radio signal we are attempting to use. To this figure is added the additional attenuation which results from on-hip portable use, and the in-building attenuation caused by the surrounding structure.

The software used is a well-known package in the industry (RadioSoft's ComStudy, Version 2.2), and is the same package used by numerous public safety agencies, as well as our State's public safety frequency coordinator and our national frequency coordinators. The software offers a choice of propagation models to use; the propagation model used for this project was Longley-Rice (Version 1.2.2). Longley-Rice has been standardized, and is in use (and accepted by) the F.C.C. for many types of analysis. Since 1999, the F.C.C. itself has been using RadioSoft's ComStudy in both its Washington, DC and Gettysburg, PA processing and engineering centers.

K) Determining Coverage for New Milford

Repeating earlier statements, New Milford, as is true for many parts of Connecticut, has a highly varied terrain that is difficult to effectively cover with radio signals, especially VHF radio signals.

We could find no single site that could provide Town-wide, in-building 95% coverage, 95% of the time. The investigation of potential sites included the following:

A) 49 Poplar Street (Tower)
1) O&G (Tower)
2) Geiger Road (Tower)
3) Chapin Road (CL&P Tower)
4) Dorwin Hill Road (Private Garage, roof-mounted pole)
5) Lanesville Fire house (wall-mounted, roof line pole)
6) Gaylordsville Fire house (dedicated telephone-style pole)
7) Sara Noble Intermediate School (roof-mounted pole)
8) New Milford High School (cupola-mounted antenna)
9) Candlewood Farms Airport (roof-mounted pole)
10) Chestnut Land Road (Sprint monopole)
11) 103 Ridge Road (Crown Media tower)
12) Kent Hollow area (roof-mounted pole)
13) Straits Rock area (Route 7) (roof-mounted pole)

Details for each of these sites follow. Talk-out, on-hip coverage propagation analysis charts for each location are attached to this report.

L) Detailed Site Analysis

The propagation analyses were run at the 95%-95% confidence level, with signal levels corrected for the additional loss caused by a wood-frame residential structure. The following analyses describe single-site coverage only.

A) 49 Poplar Street (Town-owned tower @ New Milford Police Department)

This site provides good coverage to the downtown area and the hospital, and generally fills the area between the ridges, however, significant holes appear in the coverage in the area of Lanesville firehouse, and large gaps appear towards Gaylordsville and also towards the north-central part of the Town.

1) O&G (Tower)

This site provides substantial coverage in the northern part of town. In a multi-site system design, this site is the one that will provide the most consistent coverage throughout the Town, and should be the site designated for use if it is necessary to run in single-site mode (wireline carrier failure, extended power failure, etc.). However, this site alone cannot provide in-building, on-hip portable coverage Town-wide.

2) Geiger Road (Tower)

This site provides substantial coverage in the northeast part of town, as you would expect. However, the signal from this site is not strong enough for portable coverage in the downtown area, and there is no coverage of Gaylordsville.

3) Chapin Road (CL&P Tower)

This site's coverage is similar to Geiger Road. However, downtown coverage is even lighter; in fact, all along the river south of the bridge coverage is poor.

4) Dorwin Hill Road (private garage, roof-mounted pole)

This site, in use by N.M. Community Ambulance, provides surprisingly good portable coverage to the area south of downtown, with the exception of the immediate vicinity of the river. While certainly not a single-site solution, this site is worth considering as an option in a multi-site mix.

5) Lanesville Fire house (wall-mounted, roof line pole)

The Lanesville firehouse, due to the low altitude of the antennas (immediately above the roof of the truck room) provides a very local coverage area, from Sara Noble Intermediate School southward. However, it does not cover the far southwestern corner of the Town.

6) Gaylordsville Fire house (proposed new 150' Cellular Site)

The exiting telephone pole-mounted antenna, located to the east of the truck room at Gaylordsville firehouse, does not have sufficient altitude. There is a proposal for a cellular carrier to install a monopole behind the Gaylordsville firehouse, and coverage was calculated using the top of a proposed 150' tower at that location. Talk out and talk back coverage is much better than the existing low site, but still does not extend far

beyond the immediate Gaylordsville area. From east to west, 3.4 miles, centered on the firehouse, is all that is covered. Northwest/southeast, the coverage is significantly larger, as the signal follows the river valley from well past the Town boundary in the northwest to 3 miles southeast of the firehouse. Using the additional altitude provided by the cellular site, this location would be an important part of the combined system, providing nearly seamless coverage with other proposed sites to the south and east.

7) Sara Noble Intermediate School (roof-mounted pole)
Another surprisingly effective site; as with Dorwin Hill Road, this site has just enough altitude (and a tall school roof for mounting) to take advantage of the alluvial plain that makes up the southern part of New Milford. This is a site that should stay in at least the receive antenna mix.

8) New Milford High School (cupola-mounted antenna)
This site was added by the Police Department in order to improve portable talk-back for the S.R.O. assigned to the High School. It is likely too high to serve effectively in that role, and its contribution to overall system coverage is overshadowed by Sara Nobel I.S., which is head-and-shoulders better than the High School.

9) Candlewood Farms Airport (proposed roof-mounted pole)
This site was suggested as a possible fix to the shadow created by the first ridge west of Route 7. While it does improve coverage in the immediate vicinity of the airport, it doesn't clean up the issues along the western border of the Town that lie north of the airport.

10) Chestnut Land Road (Sprint monopole)
This site's coverage is comparable to Geiger and Chapin. It provides better coverage in the northeast part of Town, but it is marginally worse than Geiger in covering the west-center part of the Town.

11) 103 Ridge Road (Crown Media tower)
This site is the best of all the eastern ridge line locations. While the coverage in the northeastern part of Town is not as smooth as Chestnut, Geiger or Chapin, it provides wide coverage, including downtown and southern Route 7 past the High School (it does a good job of "lighting up" the eastern face of the first ridgeline west of Route 7, and even provides some coverage in the area of Candlewood Farms airport, and north of the airport.

12) Kent Hollow Road (proposed roof-mounted pole)
This site, located in the far northeastern part of Town, provides coverage in the Hollow area, and illuminates an area in the extreme northern portion of the Town, under the cutoff of Geiger's ridgeline (from Geiger, looking north, there is a sharp drop off into the Kent Hollow area which prevents solid receive coverage). Most of the coverage provided by this site is out of Town.

13) Straits Rock area – Route 7 (proposed roof-mounted pole)

A building-mounted site was considered for this location, which could provide talk-in (receive) coverage in the corridor along Route 7 between Gaylordsville and the center of Town. As you might expect, the coverage is centered on the Straits Rock area, starting in the vicinity of the Gaylordsville Fire Station and extending one mile south of Straits Rock. Coverage is very limited east and west, extending only ½ mile West and 1 mile east of the location.

M. Simulcast Analyses

As previously stated and shown in the detailed propagation maps, no single site provides the required coverage. Therefore, multiple transmit and receive sites will be required to achieve the desired coverage.

For this analysis, we looked at a simulcast solution. Simulcast is the term for using two or more transmitters at the same time to improve the coverage in the service area.

Based upon the individual detailed site analyses, we attempted to configure the minimal number of simulcast sites to attain the desired level of coverage. We looked for the optimum mix regarding coverage versus expense. In overview, the evaluated configurations follow. In all of these configurations, the assumption is made that the Gaylordsville site will be increased to at least 100' above ground level (either on a new cellular site or by site improvement funded by the Town):

1) Three-site simulcast, using NMPD, O&G, and Gaylordsville
   A great improvement over any of the single-site systems, this configuration provides superior coverage though most of the Town, while leaving some uncovered areas in the north-central and central-west, and southern parts of Town.

2) Three-site simulcast, using Sara Noble, O&G, and Gaylordsville
   Improves the southern coverage versus the mix using PD HQ, above, but has the same nagging problems in the northeast part of Town.

3) Four-site simulcast, using Sara Noble, O&G, Geiger Road, and Gaylordsville
   This mix provides better than 95% talk-out and receive coverage within the Town limits.

N. Receive Analysis

Multiple receivers are used in both simulcast and single-site systems, and in fact, are in use in the existing Fire and Police systems. These "voting receivers" can either be co-located with transmitters, or can be placed by themselves where coverage needs dictate.

The four-site receive map shows the performance for on-hip, portable talk back using four receivers co-located at the four simulcast sites. Coverage meets the 95% criteria Town wide, contingent upon the assumption that the Gaylordsville site elevation will be increased to a minimum of 100'.

However in order to provide a local backup for the entire radio system at Police Headquarters/Communications Center, and to improve performance in the downtown area, the Hospital, and in Police Headquarters itself, a fifth receiver is recommended to be installed at Police Headquarters. This receiver, in conjunction with the local control stations, can be configured to provide disaster recovery mobile coverage to the Town in the event of a complete network failure. The five-site receive map shows the on-hip, in-building coverage for this configuration.

O) Number of Frequencies and their Assignment

Currently, the Police use 155.910 and 154.860 paired in a repeater system, and 156.0675 as a simplex (tactical) channel; the Fire Departments use 150.805 and 154.3475 paired in a repeater system, 155.8725 in a simplex system (Gaylordsville), and 158.4000 (used by Fire Police); the Community Ambulance is currently implementing 155.8575 and 159.3525 paired in a repeater system; DPW is using 45.200 in a simplex system; and the New Milford Water Pollution Control Authority is using 155.0550 in a simplex system.

There are a number of low band frequencies licensed and available, including the common Fire frequency of 33.700, but those will not be evaluated further in this report. Gaylordsville has an additional high band frequency, 155.8725, which is available for either base station and/or mobile use.

P) Common Complaints about Current System

Common complaints that surfaced during the needs assessment included: Poor coverage throughout Town, including non-existent in-building coverage in many locations; difficulties caused by the need to change frequencies in different parts of Town (Gaylordsville vs. downtown), especially as that affects Fire paging (some members carry two pagers in order to deal with this problem). Judd's Bridge and Mud Pond were named as two of the worst locations for coverage; indeed, most of the reported problem areas were in the north-central and northwest parts of Town. In these locations, portable radios were often inoperative even standing on the street. Additionally, there were issues with interior coverage in large buildings in the southern and central parts of Town, most notably the new High School, even though a receiver has actually been placed on the roof of the High School.

Q) Operational Issues with Current System

Separate from the coverage issues already described, there are other issues related to the present configuration, which affect the overall efficiency of the system.

The current configuration has two separate frequencies for the fire departments, and a third for the Ambulance. All of these show up as separate appearances in the PSAP. Telecommunicators must pick the correct transmitter to transmit the call for service. In the context of emergency calls and the pressure they represent, requiring this selection on

every call make it more difficult for the TCs to do their job efficiently, and it increases the chances of an error.

Fire users who do not scan are often unaware of radio traffic that may exist on the other Fire frequencies, which the TCs are obliged to hear and respond to. This creates problems for the TC handling Fire, because it is possible for three radios to require the TC's attention at the same time. The reorganization of the radio channels that is a part of this report will eliminate some of this problem.

Critical to the proper operation of any radio system are the protocols set and enforced for all users. One issue is the use of fireground channels versus use of the repeated channel. An accidental outcome of the improvement in system coverage (particularly in-building coverage) is that the pressure to leave the dispatch channel and use the on-scene channel is reduced (if the main system coverage is good into buildings, field users see no personal upside to changing over to a simplex, on-scene channel). This can create a communications overload on the dispatch channel, and prevent the equitable sharing of the dispatch channel and its dispatcher among the Fire Departments. It can prevent the timely dispatch of subsequent calls. And it can also create a safety issue, since it is not predictable when the fireground channels will be used. Resources that are not used regularly, that are not trained on regularly, will not be used when they need to be. The three Fire Departments need to standardize their policy and procedures regarding their use of the radio system, so that it is clearly understood when the repeated channels are to be used, and when they are not to be used (i.e., proper use of dispatch channel must be for dispatching only and moving over to the fireground channel must be mandatory on multi-unit responses).

R) Interoperability Issues

Fire Departments are very interested in mutual aid communications. It is not uncommon for New Milford units to respond out of town, and the reverse is also true. For many years, the common Fire frequency of 33.70 MHz made communications between departments simple. It created problems, though, when the different Departments interfered with each other when they have simultaneous – but not mutual – calls. For this reason, there has been a steady migration over the years of departments in this area leaving the common low band frequency and going to discrete frequencies, generally in VHF high band. Many of these are dispatched by Litchfield County Dispatch (LCD). The need to preserve interoperability with neighboring departments is one powerful argument in favor of improving the existing VHF high band system, instead of trying to find a solution using frequencies in any other band. The second argument for staying with high band is the in-town interoperability issue – communication between different department of the Town. By keeping all Public Safety users in VHF High Band, and providing both an interim console-based interoperability connection for DPW as well as an upgrade path for DPW to follow when frequencies and funds become available, interoperability between all Town agencies will be enabled.

S) Recommendations & Costs

Based upon the foregoing, it is our recommendation that the Town configure the radio system as three repeater pairs, plus five additional low-power tactical channels in the same frequency band (VHF high band). One pair would continue as the Police repeater; the second pair would combine Gaylordsville, Waterwitch #2, Northville and NMCA (EMS) into one, Town-wide dispatch and paging channel; the third pair would provide repeated, Town-wide communications off of the main dispatch channels in order to comply with NFPA #1221 requirements. The five additional, non-repeated (simplex) tactical frequencies would be available for on-scene use by each of the three fire departments, as well as Police and EMS

The Fire Services have objected to this operational design, and do not want to combine the EMS traffic onto the Fire dispatch channel. As configured herein, the third repeater could be used (full time) by EMS. This would remove EMS traffic from the channel used by Fire. However, this means that there will be no reserve, Town-wide repeater channel that can be shared by all users, and the only extra capacity will be on the five simplex tactical channels provided. It will not allow the dispatchers to streamline their dispatching operation during multiple-agency dispatches, and even though the frequencies will be separate, because (as stated earlier) both services are competing for the attention of the same dispatcher, this design will not result in improved access to, or service from, the communications center.

In order to provide the required on-hip, in-building coverage, each of the three repeater systems will be configured as a simulcast system. This is the best solution for radio coverage on VHF high band for the Town of New Milford, using four transmit sites located on the northwest, north center, northeast, and southwest areas of the Town, with an additional receive site at Police Headquarters. This should provide better than the required 95%-95% coverage talk–out and talk-in. Simulcast will also provide automatic backup in case of a single base station failure, because of the overlapping coverage available between sites.

The cost for a simulcast system is much higher than single-site transmit systems. Much of the cost is in engineering and setup, rather than in equipment. Costs are higher: because (using Motorola here as an example) such systems are "staged", that is, assembled and tested in a special area of the Motorola Schaumburg, Illinois facility (M/A-Com systems are staged in Harrisburg, PA); because of the system build complexity, all simulcast systems have project management (and the associated costs) assigned to the project; and because of the costs associated with on-site optimization of the system.

The total cost assume that the five sites (or other similar, adequate sites) are available at no cost to the Town. The total cost includes site improvements to install Town equipment, but does not include any rents. The Gaylordsville site requires additional altitude, but we have not budgeted costs for that, pending the installation of a new cellular antenna at the firehouse. We have discovered that Geiger Road is at capacity and

in need of improvement, and approximate costs for a tower strengthening and/or shelter change at that location are included in the budget estimates.

T) Digital Option:

We have evaluated digital and analog solutions for New Milford. Digital radios are available for Public Safety, using an ANSI-standard modulation commonly known as "P25", and several systems within Connecticut are now operating: the State Police, and the Towns of Woodbury, Wilton and Darien on this side of the State. Digital radios would improve system coverage, and can make the difference in marginal areas between a system that does and does not provide service inside buildings. However, our analysis of New Milford shows that a minimum of four transmit sites will be required for any system, digital or analog. Digital's improvement to coverage is not sufficient to make a three-site system provide 95%-95% coverage. Not selecting digital makes encryption impractical, so if encryption is a requirement digital also becomes a requirement. We can keep the Town's options open by ensuring that the backbone of the system installed will be digital-capable, and can be upgraded later if the Town desires. The cost increase for digital is mainly in the subscriber units, which would be 1.5 to 2 times as expensive as equivalent analog units. Also, remaining analog radically reduces the subscriber unit costs, since the existing Town radio fleet is narrow-band capable and will be re-used. Additionally, it prevents the creation of a paging problem for Fire and Ambulance, since at this writing there are no digital voice pagers available.

U) Additional Costs Associated with Project

Items that represent additional necessary costs for this project are:

1. AT&T Circuits to remote radio sites, to connect the remote sites to the master site (where receiver audio is voted, and simulcast audio is parceled out to the transmitters), which will be Police Headquarters. Circuit costs to be determined.

2. Replacement/installation of new control stations (local base units at Fire stations that allow direct communications between fire stations and the trucks; as well as additional units for the dispatch center as backup to the wire line connections from AT&T. These costs are included in the estimated costs in this document.

V) Potential Roadblocks

Items that could cause problems in this project would include:

1. The cost of risk-taking by responding vendors. While we have done the preliminary propagation analysis, it should be the Town's intention to write a Request For Proposal that puts the performance guarantee where it belongs, with the vendor, rather than with the Town. The vendors will, of course, perform their own analysis. Our backbone prices represent list price plus contingency. The vendors' response prices may be higher in order to capture their risk exposure.

2. Inability to license suitable frequencies. The Town has, on paper, sufficient frequencies to be able to implement the three-repeater configuration described previously. However, in order to use the licenses in a simulcast configuration the licenses will need to be modified; and it is possible that a co-channel or adjacent channel occupant may object to the change.

3. Unexpected, discovered interference. In a multi-site, voted receiver system such as this, it is necessary to place sensitive receivers at each of our sites in order to receive the weak signals from the portable radios. The current VHF high band receivers have relatively low-altitude antennas at the present time. New, higher sites may expose the receivers to distant interference that may not be apparent at this time. It is possible that, upon powering up the receivers at the new sites, we will find interference that will render the frequency impaired because the receivers will effectively be "deafened." This danger can be mitigated by engaging a vendor to monitor the input frequencies we find for a period of time from an appropriate location(s) before committing to equipment purchase.

4. Unavailable cellular sites. The analysis in this report uses existing or proposed Cellular/CL&P sites as antenna locations, in order to avoid (wherever possible) construction costs and the attendant zoning issues. If these sites (or acceptable substitutes) are not available, or if refurbishment/repair costs (at Geiger) are higher than predicted (due to now-unknown factors discovered during the project) the project could be delayed.

W) Follow-up

The Town will need to make a decision on what level of communications performance they are willing to buy. The higher levels of confidence (i.e., above 90%) are expensive to purchase, but public safety requirements force that issue. The costs described below are based on 95%-95% coverage (Public Safety defacto standard).

Following the Town's decision, an RFP must be written. The RFP will include suggested, available radio sites that could be used. The Town will review the RFP responses, and analyze the vendor responses against its own information. The vendor may recommend a radio site or sites not currently available to the Town. If the Town accepts that recommendation, the site would need to be procured; where the site is not Town-owned, negotiations would need to be conducted to obtain the desired location(s).

X) Map Index

Maps are located at the end of the document. Maps 1 through 14 show outbound to portable. Maps 15 and 16 show inbound from portable.

Map A: 49 Poplar Street (NMPD)
Map 1: O&G

Map 2: Geiger Road
Map 3: Chapin Road
Map 4: Dorwin Hill Road
Map 5: Lanesville Fire house
Map 6: Gaylordsville Fire house
Map 7: Sara Noble Intermediate School
Map 8: New Milford High School
Map 9: Candlewood Farms Airport
Map 10: Chestnut Land Road
Map 11: 103 Ridge Road
Map 12: Three-site simulcast (Police HQ, O&G, and Gaylordsville)
Map 13: Three-site simulcast (Sara Noble, O&G, and Gaylordsville)
Map 14: Four-site simulcast (Sara Noble, O&G, Geiger Road, and Gaylordsville)
Map 15: Four-site receive (Sara Noble, O&G, Geiger Road, and Gaylordsville)
Map 16: Five-site receive (NMPD, Sara Noble, O&G, Geiger Road, and Gaylordsville)

4. Costs / Budget Estimates

The cost estimates for the new communications center and radio system are broken out into three cost centers. Supporting documentation for certain items included are attached to this document. The three cost centers and their budgetary estimates are as follows:

a) Civil Construction/Infrastructure work:
Preparation of the existing training room space and EOC space, wall demolition, new wall construction, minor structural modifications, electronic access control doorways, adding a new bathroom, adding a new kitchenette / break room, associated plumbing, electrical, and HVAC modifications (including fixtures). This information furnished by Town DPW, based upon design drawing of 1/25/07 (see attachments). Line items for these changes are listed below:

i. Lobby/Entry	$ 58,392
ii. Training/EOC	$ 38,053
iii. Dispatch Room	$ 1,978
iv. Plumbing/Electric/HVAC	$ 106,800
v. Architects fees	$ 41,045
Civil total:	**$ 246,248**

b) Specialized Communications Center Systems and Equipment:
Provisioning of the radio communications equipment for the room. Items in this cost center are detailed below:

a) Radio Console System **$225,000**

Includes multiple channel controls with redundant control modules, instant call check recorder / playback capability, backup power supplies, all necessary radio control stations (for outside agencies, monitoring PD and FD dispatch frequencies, and for emergency backup), spares kit to allow rapid repairs, including installation of all communications wiring and protection of existing dispatch center functionality during the construction / transition phase.

b) Console furniture & equipment **$ 52,000**

Three-position console, fully-equipped with ADA-compliant movable workstation surfaces, climate control and lighting, central resource center, five intensive-use chairs, sized to permit two PCs / four to five video displays per position.

c) Uninterruptible Power Supply **$ 10,000**
Supplies and conditions power for critical communications center equipment. Keeps equipment operating until generator can start, protects equipment from surges and spikes from either commercial power or the generator, and provides time to implement the emergency plan in the case of a generator non-start.

d) PCs and monitors: $ **18,000**
Replacement PCs/Monitors for CAD, RMS, COLLECT, etc.

e) Printers: **$ 2,000**
Replacement COLLECT and in-house system printers.

f) Legacy Equipment MAC: **$ 3,000**
Moves, Adds and Changes for any existing servers, switches/routers and other building support equipment that is not being replaced (but must be moved/modified while live to preserve continuous service). This estimate developed with the assistance of Bob Lovell

g) R56 Grounding compliance costs: **$ 2,000**
Providing a single-point, isolated ground system for connection to all communications center electronic equipment.

h) Security Monitoring System: **$ 800**
Moving existing building security video monitoring / control equipment to new communications center. This estimate developed with the assistance of Bob Lovell.

Specialized Systems total: **$312,800**

c) Radio Systems and Equipment:

i. Four Site transmit, three channel analog simulcast Radio System, VHF High Band: **$ 1,251,000**

ii. Control Stations (Consolettes) (7) **$ 49,000**
One consolette for each Fire Station, plus three for the dispatch center as backup to each of the wire line connections.

iii. Option: Site Improvements **$ 100,000**
Tower construction, one site – to be determined

Radio Systems and Equipment total:	**$ 1,400,000**
All Communications Items Subtotal:	**$ 1,960,000**
Contingency @ c.5%	**$ 100,000**
Total (including all options)	**$ 2,060,000**

Costs that are not included in this Needs Assessment:

1) EOC Furniture, Fixtures and Equipment. Likewise, the FF&E for the new public conference room and the renovated records department is also not included.
2) Subscriber units. As this is an analog system, and the equipment in use by New Milford is narrow-band capable, no subscriber equipment with the exception of Consolette/Control Stations has been specified.
3) AT&T circuit charges.

Conclusions:

Oliver Associates recommends that the Town of New Milford proceed to Phase II of its Communications Center/Radio Project. We recommend the utilization of the existing training room/EOC as the new communications center space. We also recommend planning for a four-site simulcast system. Finally, we recommend that the Town consider using combined dispatch for Fire and EMS, in order to gain the efficiencies inherent in that design.

Attachment List:

1. Conceptual Design Drawing 1/25/07
2. Estimate for Renovations – DPW
3. Furniture Layout Drawings, "A" and "B"
4. Radio Propagation Surveys.
5. Frequency List.