



Professional Consulting Services Communications Consultant E-911

Operational Enhancement Analysis

Sullivan County, New York

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Appendix A

No Appendices

1. Introduction

With an understanding of the baseline methods of operations and existing system capabilities, Blue Wing has refined the operational enhancements desired by the County. In addition, additional meetings with key stakeholders to gain greater insight into operational requirements and limitations were conducted to refine the desired enhancements. The operational enhancements recommended have primarily focus on maintaining essentially the same method of operation, but providing a more reliable, efficient process.

2. County Radio System Users

Radio System Users

Primary radio system users are those departments and agencies that will use the system for their primary method of communications. These users must be able to effectively communicate within their groups. Although law enforcement is currently not a primary user of the system, law enforcement channels will be integrated into the system in their current form. The system will be designed to provide equipment capacity for additional law enforcement needs.

County Departments

- Fire
- EMS
- Emergency Management
- Highway Department
- Other County Departments

Interoperable Radio System Users

While the County sheriff's and the three local police departments' radios systems are not part of this project, provisions will be made to ensure that the sheriff's system preserves its current functionality. In addition, gateways via interoperable common channels will be provided to allow federal, state and local users to interoperate with the County's user and communications system resources in VHF-low band, VHF-high band, UHF and 800 MHz.

3. User Operational Methods

Calls for service are received at the County communications center via E-911 or seven-digit telephone. The call taker/dispatcher will assess the location, type of response required, and dispatch the appropriate units/agencies per standard operating procedure (SOP).

The dispatcher in the future operations will become the controller of the communications resources and will assign the channels as needed to the various incidents. The dispatcher's role will be to react to emergency calls and resource requests from the field personnel responding to incidents.

Police Dispatching – As is currently the policy, the County communications center will poll for a police unit to respond to an emergency call for service. After a unit has been assigned, the unit will communicate with its respective dispatch center.

Fire and EMS Dispatching – The dispatcher will alert the appropriate agency via an alphanumeric paging and alerting system. When dispatching EMS, the dispatch resource determination will be aided by the use of AVL and nearest responder location. The alphanumeric system will also be used to activate station sirens. Communications from all responding units would occur on the dispatch talk path. There will be a separate dispatch talk path for fire and for EMS.

For each fire service call for service, the dispatcher will assign a tactical talk path. Tactical talk paths shall be used for on-scene communications. Specific tactical operations will have dedicated talk paths. These include fire, police, water supply, and landing zone. Chief officers can request additional tactical talk paths for an incident via the dispatcher. The tactical talk paths will not be monitored by the dispatcher.

County Highway – Communications occurs between the County Highway Department offices, field units and between units in the fields. The County communications center will also have access to the Highway Department talk paths. The communications center may monitor Highway communications but will not be the department's primary dispatch point.

4. Talk Paths Required

Throughout the report the term “talk path” is used. Talk path equates to a frequency or channel in a conventional system or a talk group in a trunked system. In a conventional system, the use of an additional talk path would require acquiring additional frequencies. With a trunked system, additional channels would only require programming another talk path into the system and no additional frequencies. A sufficient number of talk paths are required to support primary users within their service areas. The following shows a plan to meet the current and projected talk path requirements. There is a requirement that all radios within a given service have a similar channel plan. Within the fire service/EMS, all radios would have the same talk path channel plan. The talk path plan allows for the use of department unique talk paths. The addition of interoperable talk paths would not increase the number of talk paths needed. It would be assumed the interoperable channels would be patched as needed by the dispatcher to the required channel.

Therefore, a conventional system would require a minimum of 4 and preferably 8 repeater channel pairs in the chosen band. In addition, approximately 8 simplex mobile-only channels would be required. A trunked system would need a minimum of 5 to 6 repeater channel pairs in the chosen band.

In addition, the following operating practices are suggested to be followed to optimize the performance of the proposed radio system to minimize the use of wide-area talk paths and to use tactical talk paths when appropriate. Whenever possible, use national interoperability channels to manage specialized interoperations situations. In addition, expand the use of digital paging to include sending messages to reduce voice communications when messaging would provide comparable or better transfer of information. The County should establish standard operating procedures (SOP) for radio system usage for dispatch and field operations. The SOP would provide guidance on when to use specific talk paths and the management of talk path resources.

The table below outlines the basic channel plans.

| | Name | Radio Position | Frequency | Type | Area of Operation |
|--------------------------|------------|----------------|-----------|------------------|-------------------|
| Fire/EMS | | | | | |
| Alerting/Paging | NA | | TBD | Simplex | County-wide |
| Communications | COM-FIRE | 1 | TBD | Repeater | County-wide |
| Communications | COM-EMS | 2 | TBD | Repeater | County-wide |
| Commnciations | COM-F/E/LE | 3 | TBD | Repeater | County-wide |
| Tactical | TAC-1 | 4 | TBD | Simplex/Repeater | On-Scene/CW |
| Tactical | TAC-2 | 5 | TBD | Simplex/Repeater | On-Scene/CW |
| Tactical | TAC-3 | 6 | TBD | Simplex | On-Scene |
| Tactical | TAC-4 | 7 | TBD | Simplex | On-Scene |
| Tactical | TAC-5 | 8 | TBD | Simplex | On-Scene |
| Tactical | TAC-6 | 9 | TBD | Simplex | On-Scene |
| Tactical | TAC-7 | 10 | TBD | Simplex | On-Scene |
| Tactical - Transport | TAC-8 | 11 | TBD | Repeater | County-wide |
| Interop - State Fire | SI-FIRE | 12 | TBD | TBD | TBD |
| Interop - EMS - Call | HEAR -205 | 13 | 155.205 | Simplex | County-wide |
| Interop - EMS - State | HEAR -715 | 14 | 155.715 | Simplex | On-Scene |
| Interop - EMS - Hospital | HEAR-400 | 15 | 155.400 | Simplex | Amb-Hosp-BLS |
| Interop - EMS - Hospital | HEAR-340 | 16 | 155.340 | Simplex | Amb-Hosp-BLS |

Table – Fire Service/EMS Channel Plan



| | Name | Radio Position | Frequency | Type | Area of Operation |
|------------------------|--------------|----------------|-----------|----------|-------------------|
| Law Enforcement | | | | | |
| 911 Dispatch | 911 Dispatch | 1 | 151.370 | Repeater | County-wide |
| Sheriff's Dispatch | Sheriff | 2 | 151.190 | Repeater | County-wide |
| Commnciations | COM-F/E/LE | 3 | TBD | Repeater | County-wide |
| Tactical | LE TAC 1 | 4 | TBD | Simplex | On-Scene |
| Tactical | LE TAC 2 | 5 | TBD | Simplex | On-Scene/CW |
| Tactical | TAC-1 | 4 | TBD | Simplex | On-Scene/CW |
| Tactical | TAC-2 | 5 | TBD | Simplex | On-Scene/CW |
| Tactical | TAC-3 | 6 | TBD | Simplex | On-Scene |
| Tactical | TAC-4 | 7 | TBD | Simplex | On-Scene |
| Tactical - Transport | TAC-8 | 10 | TBD | Repeater | County-wide |
| | | 11 | | | |
| | | 12 | | | |
| | | 13 | | | |
| | | 14 | | | |
| Interop -Tactical | MRD | 15 | 155.370 | Simplex | On-Scene |
| Interop -Tactical | Nationwide | 16 | 155.475 | Simplex | On-Scene |

Table – Law Enforcement Channel Plan

| | Name | Radio Position | Frequency | Type | Area of Operation |
|---------------------|------------|----------------|-----------|------------------|-------------------|
| Public Works | | | | | |
| Communications | COM-DPW | 1 | TBD | Repeater | County-wide |
| Communications | COM-EMS | 2 | TBD | Repeater | County-wide |
| Communications | COM-F/E/LE | 3 | TBD | Repeater | County-wide |
| Communications | COM-F/E/LE | 3 | TBD | Repeater | County-wide |
| Tactical | TAC-1 | 4 | TBD | Simplex/Repeater | On-Scene/CW |
| Tactical | TAC-2 | 5 | TBD | Simplex/Repeater | On-Scene/CW |
| Tactical | TAC-3 | 6 | TBD | Simplex | On-Scene |
| Tactical | TAC-4 | 7 | TBD | Simplex | On-Scene |
| | | 8 | | | |
| | | 9 | | | |
| | | 10 | | | |
| | | 11 | | | |
| | | 12 | | | |
| | | 13 | | | |
| | | 14 | | | |
| | | 15 | | | |
| Interop - Tactical | STATE -HW | 16 | TBD | TBD | TBD |

Table – Public Works Channel Plan

| | Name | Radio Position | Frequency | Type | Area of Operation |
|-------------------------------------|------------|----------------|-----------|----------|-------------------|
| Common Interoperability Bank | | | | | |
| Communications | COM-FIRE | 1 | TBD | Repeater | County-wide |
| Communications | COM-EMS | 2 | TBD | Repeater | County-wide |
| Communications | COM-F/E/LE | 3 | TBD | Repeater | County-wide |
| NI-CALL | InterOp | 4 | TBD | Repeater | County-wide |
| NI-Tac 1 | InterOp | 5 | TBD | Repeater | On-Scene |
| NI-Tac 2 | InterOp | 6 | TBD | Repeater | On-Scene |
| NI-Tac 3 | InterOp | 6 | TBD | Repeater | On-Scene |
| NI-Tac 4 | InterOp | 6 | TBD | Repeater | On-Scene |
| | | | | | |
| | | | | | |
| | | 7 | | | |
| | | 8 | | | |
| | | 9 | | | |
| MA/Local InterOp | Local | 10 | TBD | TBD | Local/Region |
| MA/Local InterOp | Local | 11 | TBD | TBD | Local/Region |
| MA/Local InterOp | Local | 12 | TBD | TBD | Local/Region |
| MA/Local InterOp | Local | 13 | TBD | TBD | Local/Region |
| MA/Local InterOp | Local | 14 | TBD | TBD | Local/Region |
| MA/Local InterOp | Local | 15 | TBD | TBD | Local/Region |
| MA/Local InterOp | Local | 16 | TBD | TBD | Local/Region |

Table – Interoperability Channel Plan

Radios would use two talk path banks – Bank 1 would be for in-county communications, while Bank 2 would be for interoperability and department-specific locally used talk paths.

5. Coverage

Paging – Paging coverage shall be designed to activate pagers worn on the hip in the street in 95% of the area in the County with 95% reliability. The paging signal shall be simulcast from all towers at the same time.

Two-way voice – Two-way voice communications shall support the effective two-way communications between mobile vehicular units and the communications center. Two-way mobile voice coverage shall provide 95% mobile in-street area reliability with 95% reliability. The required voice quality shall be DAQ of 3.4 or better. The two-voice signal shall be simulcast from all towers at the same time, and the best received signal at the base station shall be chosen to be heard by the dispatchers.

6. System Features and Functions

Analog System – The system features and functions recommended are highly dependent on the protocol that will be used. If the system remains analog and depending on the duration of the system remaining analog, it would be recommended that MDC-1200 type signaling be implemented. The signaling would allow for radio unit (UID) and emergency capability at the subscriber radios and dispatch center, as well as status messaging. In addition, because of the methods used to simulcast, voice security would not be available on an analog simulcast system.

Digital P25 System – Project 25 supports UID, emergency, status messaging, and applications such as AVL and text messaging. These features could be available to all users of the system and would allow additional information even when using portables. This would allow for the basic operations to be enhanced greatly. UID and emergency would give the dispatchers and other radio users better situational understanding of who is transmitting and/or activated the emergency button. AVL integrated with the dispatch system, especially in the case of EMS and law enforcement, would allow for efficient dispatching of closest vehicle.

Voice security via Advanced Encryption Standard (AES) encryption is supported with Project 25 as an additional feature and would be recommended to ensure the system has the ability to transport encrypted messages from subscriber to subscriber and subscriber to console.

| System Feature | Analog Convention | Digital Project 25 |
|-----------------------------|--------------------------|---------------------------|
| Caller Recognition | | |
| Unit ID (UID) | Yes | Yes |
| Emergency | Yes | Yes |
| Caller Location | | |
| AVL | No | Yes |
| Messaging | | |
| Status Messaging (SMU) | Yes | Yes |
| Text Messaging | No | Yes |
| Data | | |
| 19.2K Data/NCIC | No | No |
| Broadband Data Applications | No | No |

7. Dispatch Communications

The dispatchers in Sullivan County are effective and well trained, but operate on a system that provides many basic limitations. Therefore, there are some basic changes to the communications system that would simplify operations even with current channels and limitations.

Basic Upgrades

Basic upgrades could occur and enhance the system independent of changing frequencies of any of the services.

Install all fixed T1/R1 base stations – Because the dispatch system uses T4/R4 base stations, all on the same frequencies within each department, all frequencies are muted during dispatch. This prevents the dispatchers from hearing any other transmissions from that department, even if on a different frequency, when they are paging or transmitting. Within this framework, the dispatchers are very efficient in their operations. With the use of fixed frequency base stations instead of multi-frequency base stations, dispatchers would be able to hear other frequencies while paging or transmitting. They also would not have to rely on remembering to leave at least one site on a different frequency to listen to a different channel, like fire ground.

Use Simulcast Transmit and Voted Receive Communications – With a newer radio system, dispatch operations could be simplified. With a simulcast type of system, dispatchers would not have to choose towers. Voters will allow the best received audio to be heard at dispatch regardless of the tower site. This would allow the dispatcher to operate on a single module per channel versus the multiple modules currently needed.

Similar Main and Backup Dispatch Environment – It is recommended that the main dispatch center and the backup dispatch center operate with the same communications equipment in the same methodology as the main dispatch center. Although the number of positions might be reduced, the environments should be the same.

Enhanced Upgrades

Separate Alerting/Dispatching Channel – Consolidate both EMS and fire alerting to the same band and same channel and use only one channel for alerting. This will alleviate the congestion problem that exists when alerting, dispatching and communicating over the same channel.

Upgrade to Digital Paging – Digital paging will allow the dispatchers to take advantage of the CAD data flow of information to the end-user. This will increase speed, accuracy and information. In addition, it would allow the dispatchers to be removed from many department and agency non-emergency notification issues.

Use of Enhanced System Feature Sets – The County should evaluate the use of Project 25 UID, emergency, AVL, status messaging, and possibly text messaging as less costly alternatives. These features could be available to all users of the system and would allow additional information even when using portables. This would enhance the basic operations greatly. AVL integrated with the dispatch system, especially in the case of EMS and law enforcement, would allow for efficient dispatching of closest vehicle.

Expanded Interoperability Channels – The County should include the ability to monitor and communicate on the national interoperability channels. This will provide the greatest amount of flexibility of the potential responding agency to intercommunicate to the dispatcher and allow for these talk paths to be patched to County communications channels.

Dispatch Center to Dispatch Center Interoperability Communications – The County should include the ability to interconnect one or more direct communications channels to the bordering dispatch centers. This would greatly enhance the ability to cross patch multiple County communications talk paths and allow for efficient handling and transfer of border incidents.

Other Areas

Consolidated Dispatch Center – Most counties have, or are moving to a fully consolidated 9-1-1 and dispatch center. Although sometimes politically painful, the cost savings and centralization of services can provide significant benefits. This was not evaluated or integrated into the plan because this concept seems to need more time to fully mature in the County.

8. Paging Methods

Dedicated Paging/Alerting Channel – It is recommended that the County move to a common channel for alerting/paging of both EMS and fire personnel. This channel should only be used for alerting/paging of fire and EMS personnel. This would alleviate many of the issues with voice/paging access/interference issues that occur today.

Simulcast Paging – The single channels used for paging should be simulcast across an area of required coverage to eliminate the need for multiple transmissions to send a page.

Upgrade to Digital Paging – Digital paging will allow the dispatchers to take advantage of the CAD data flow of information to the end-user. This will increase speed, accuracy and information. Also, sensitive information can be sent over the digital paging service without the general public scanning devices monitoring the transmission. In addition, it would allow the dispatchers to be removed from many department and agency non-emergency notification issues. A detailed review of digital paging attributes is provided in Appendix A.

The brief overview of digital paging provides high-level advantages of digital paging.

- Less expensive pagers, typically \$150 to \$100 vs. \$400 to \$500 for an analog voice pager.
- The ability to continue the information flow without human intervention from the CAD system, reducing errors and increasing the amount of information sent.
- More efficient use of frequencies, because typically, digital pages require less time to be sent compared with a tone/voice page.
- The ability to expand the paging system use to other departments and uses within the County. The pages can be prioritized to allow the emergency services pages to always have highest priority and the lower level pages to be sent as time is available. The devices display the call information on a message screen or similar device.

9. Data Methods

Low Speed Data – The enhanced data features implemented by the County should be a commonly supported part of the protocol. Analog conventional does not inherently support any type of data. Digital Project 25, either conventional or trunked, supports a number of basic data features. UID, emergency, and status messaging, are low-cost additions to purchasing a digital Project 25 system and are embedded in the protocol. Additional applications such as AVL and text messaging are also supported by the protocol. These features could be available to all users of the system, and would allow additional information even when using portables. This would enhance the basic operations greatly. UID and emergency would allow the dispatchers and other radio users to have a better situational understanding of who is transmitting and/or activated the emergency button. AVL integrated with the dispatch system, especially in the case of EMS and law enforcement, would allow for efficient dispatching of closest vehicle.

High Speed Data and Broadband – Currently, the County has marginal cellular coverage with many dead spots. However, the coverage will continue to improve over time. At this time, it is best that the County continues to first focus on the voice and low-speed data solution. It is recommended that in the short term and most likely the long term, due to the cost of a private data system, that the County focus on solutions provided by commercial carriers. The carriers have significant penetration into the public safety marketplace and continue to improve not only the application integration but also the data speeds. It is the belief of most industry experts that a County would be unable to provide a private data system at a commercially competitive cost or recycle the technology at a rate to keep up with advances in the commercial marketplace. If the County has concerns about the coverage, it is recommended the County look at creating known hot spots at government facilities in which a subscriber could roam into and transfer information as needed.

10. Interoperability Requirements

Currently, the County has limited interoperability capabilities via various law enforcement, EMS and fire channels. The majority of these channels are used for on-scene communications. The County dispatch center has a small group of channels that support base station operations that would provide interoperability.

The County would implement a straight forward plan with three levels of interoperability.

Level 1 – The first level would facilitate County interoperability across the various County services. All services would have a common group of tactical channels. These channels would be assigned by the dispatcher and could not be used unless approved by the dispatcher. The majority of the time these channels would be used for fire operations but could be used for interoperability between services as needed. This level would also support the New York State commonly used interoperability channels. All level 1 channels would be programmed in the main bank of 16 channels used in the radio.

Level 2 – The second level would be to allow local commonly occurring interoperability instances such as fire mutual aid in County border areas to continue to share each other's frequencies to work together. Therefore, the County would allow mutual aid agencies from other Counties to program the County's frequencies in its radios to interoperate. Level 2 and Level 3 channels would be in the same bank or separated into two banks of channels depending on the number of channels required.

Level 3 – For the third level, the County would also support the national interoperability plan and program the band-appropriate channels in each radio to allow communications between a host of agencies providing mutual aid during a large incident.

These interoperability channel plans assume a similar band of operation. If different bands were required between services, then dispatcher-aided console patching would be required to allow interconnects to occur.

11. Site Standards

The following standards shall be implemented to allow for reliable radio equipment operation:

Tower –

- Towers shall meet the latest EIA/TIA tower standards for current and future predicted loading requirements.

Building –

- Buildings shall be constructed to properly modify the internal environment's heating, cooling, humidity and particle contamination to meet preferred equipment specifications
- Buildings shall meet basic security measures such as ballistic proof walls and doors.

Site

- The sites shall be level and provide proper drainage away from the site
- The site shall contain a 6-foot security fence around the building and the tower

Grounding

- The site shall be grounded to meet industry-approved grounding standards such as Motorola's R56 standard and provide the recommended resistance to ground.

Backup Power

- All sites shall have a backup generator to operate at full capacity independently for 48 hours.
- All sites shall have backup battery power to operate at full capacity for 2 hours.