Minnesota Completes Public Safety Broadband Network Pilot

Project features public/private partnership. It's the first with an electric utility.

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The state of Minnesota concluded its first ever LTE Band 14 public safety broadband pilot project in December 2015.

The pilot was designed, deployed and evaluated as part of the state's ongoing collaboration with the First Responder Network Authority (FirstNet). The authority is charged with building, operating and maintaining the first nationwide high-speed wireless broadband network dedicated to public safety. All 56 states and territories in the United States must have radio access to a network connected to the FirstNet core network.

Although pilot planning began almost two years earlier, actual network deployment, evaluation and testing didn't begin until March 2015, following approval of a Special Temporary Authority (STA) by the Federal Communication Commission for the pilot to operate over the public safety spectrum set aside for the developing FirstNet national public safety broadband network.

Minnesota's pilot is not the first public safety broadband LTE project in the United States, but it is the first of its kind in the upper Midwest. More importantly, the pilot is the first in the United States to partner in a broadband LTE Band 14 test with public safety organizations and a rural cellular carrier—NewCore Wireless, headquartered in St. Cloud, Minn. It also is the first pilot in which public safety organizations partnered

with an electric utility, Great River Energy, headquartered in Maple Grove, MN, according to the Washington, D.C.-based Utilities Telecom Council. This is significant because electric utilities are part of the Energy Sector, one of the 16 industry classifications that the U.S. Department of Homeland Security (DHS) has identified as crucial to recovery and restoration following major emergencies. Those emergencies can range from natural disasters to man-made catastrophes and terrorist attacks. Public safety is part of the Emergency Services Sector. The full list can be found by following this link: https://www.dhs.gov/critical-infrastructure-sectors.

"Our vision for the pilot project was to clearly demonstrate that broadband is no longer simply a technological discussion…it is a reality," says Mark Dunaski, deputy commissioner, Minnesota Department of Public Safety. "Broadband networks are going to happen. What all of us in public safety need to do is understand their benefits, determine how best to design and deploy them, and determine how best to use their capabilities to save lives and protect property."

The state invested considerable time to clearly define the vision that would frame the entire pilot project. There were a number of objectives.

- **Encourage an inter-agency and inter-industry conversation that would educate every agency, first responder and even allied industries about the power and**

promise of public safety broadband technology. These conversations could lead to deeper awareness of individual agency and industry broadband needs and expectations; better understanding of the impact broadband might have on existing communications policies, procedures and protocols; and appreciation of the inter-agency relationships necessary to ensure collaborative use of a network in the future.

- **Consider broadening the concept of public safety to include industries identified by DHS as critical infrastructure.** This could lead to public/private partnerships that would not only help in network deployment, but potentially provide a broader base of users that could help sustain the system economically.
- **Help public safety professionals become more familiar with currently available broadband devices, software and network options.** Knowledge and expertise presently varies widely among agencies and their personnel.
- **Explore how the state's Allied Radio Matrix for Emergency Response (ARMER) P25 mobile radio system and a future broadband network could be used in tandem to dramatically enhance situational awareness in any emergency.**

- **Keep the pilot project small so that there would be flexibility to quickly and efficiently test a variety of applications within the constricted timeframe for the pilot.**
- **Test the network's ability to prioritize communications traffic.**
- And, lastly, **demonstrate that broadband could be delivered to rural and remote areas in the state as well as urban areas, leaving no community behind.** This would ensure that the state could provide border-to-border coverage with its public safety broadband communications systems, a long-standing objective of Governor Mark Dayton.

By the time the pilot concluded in December 2015, the state believed that participants came away with a much deeper understanding of the benefits of a Band 14 LTE public safety broadband network and the critical factors that will ensure its successful deployment in the future. Among those key benefits and factors were these:

- **Broadband is a communications multiplier that benefits everyone.** The information that a Band 14 LTE public safety broadband network generates clearly enhances situational awareness in every emergency. This translates to lives saved and property protected.

- **Public/private network partnerships are possible and can be a significant asset.** Identifying and then considering possible partnerships can have a significant impact on effectively deploying, managing and potentially funding future broadband networks.
- **Education is vital to broadband's effective use.** The pilot revealed that broadband knowledge is at best uneven throughout the state. Future deployment will require a concerted effort to elevate everyone's understanding of what public safety broadband can do and how best to put its features and capabilities to use.
- **Inter-agency conversation matters in the broadband discussion.** Agencies not only must thoroughly discuss broadband among themselves, but also engage other public safety agencies and potential industry partners in their communities. For some agencies involved in the pilot, it was the first time they had had the opportunity to talk with agencies statewide about broadband. Everyone involved in this pilot found that conversation enabled them to build important relationships, understand other agencies' individual communications perspectives and needs, and set the groundwork for strong collaborative relationships in the future.

Police Chief Mike Risvold of Wayzata, Minn., and chair of the Interoperable Data (Broadband) Committee, is one of the Statewide Emergency Communications Board's (SECB) 20 members that participated in pilot project's Industry Day event.

Pilot Takes Shape

Minnesota has a long history of progressive and creative thinking to deliver the communications tools its public safety agencies need. The state has always embraced collaboration in its identification and implementation of best practice approaches to communications. It invests the time required to build consensus and support among agencies and the communities they serve.

Like other states, Minnesota knows well how important collaboration is when facing the challenges of unexpected and often catastrophic events. One of the state's most memorable is the collapse of the I-35W bridge over the Mississippi River on August 1, 2007. The eight-lane bridge carries 140,000 vehicles daily. The catastrophe occurred at

the height of rush hour. Thirteen people died and 145 were injured. Eleven area hospitals treated 98 individuals. An estimated 75 local, state and federal agencies were involved in the response.

"As we began to consider how best to approach broadband, we at the State of Minnesota's Emergency Communication Networks (ECN) believed that we could serve as a facilitator for the entire discussion," says Jackie Mines, division director for ECN. ECN manages the statewide 911 program and NG911 network, the statewide ARMER shared digital P25 radio communications network, and the ongoing interoperability program.

With the pilot exercise, Mines says ECN provided a place where public safety professionals could test broadband concepts, explore the challenges of reaching every community statewide, and test the possibility of public/private partnerships to accomplish this.

"We wanted to make broadband 'real' for everyone," she says. "We wanted to say that this is how the system could look, this is how it could operate, these are the advantages we could all receive, and this is the coverage we could achieve."

Mark Dunaski (center), deputy commissioner, Minnesota Department of Public Safety, and Jackie Mines (far right), division director of Minnesota's ECN, share pilot accomplishments since work began in March 2015 with the SEBC, and review plans for the Functional Exercise scheduled for November.

The success of the pilot was in large measure the result of the substantial investments of time, equipment and expertise of its private partners and stakeholders.

NewCore Wireless, one of the principal private stakeholders, offers hosted, full-service GSM/UMTS/LTE wireless switching services to customers in 18 states including rural carriers.

"Our main goal was to provide the state with as much broadband information as possible that it could provide to FirstNet and help the state make its best broadband networking decisions moving forward," says Albert Kangas, NewCore's chief operating officer and general manager. "Given our largely rural customer base, we also wanted to confirm that a public safety broadband network could serve everybody well, especially

rural and remote geographic users. Rural users often feel left out of the technological conversation."

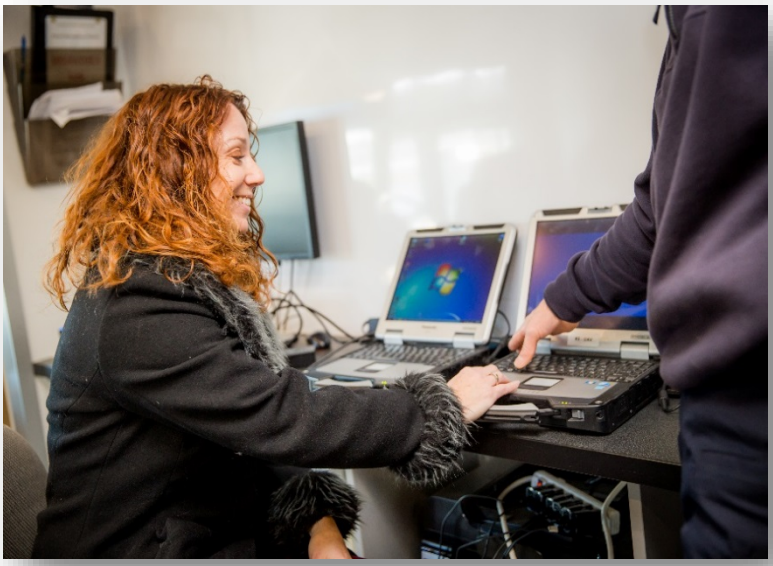
Stephanie Court, NewCore Director of Business Operations, describes the function of equipment the company used in the pilot to an Industry Day attendee. The equipment included an antenna integrated radio (AIR) unit, an indoor radio unit and a digital unit.

Great River Energy (GRE) is a regional electric generation and transmission cooperative serving 650,000 homes, businesses and farms. GRE had been researching ways to secure additional amounts of spectrum for its most important equipment monitoring activities. They believed that if they could secure a small amount of public safety broadband spectrum for their vital functions such as supervisory control and data acquisition (SCADA), they could better ensure power was available for public safety use as well as for other critical service and restoration activities in the communities they serve. In fact, one of the pilot's stakeholders, Motorola Solutions, demonstrated in its laboratory tests

that a small amount of public safety broadband spectrum could be shared with an electric utility for functions such as SCADA without compromising the priority and availability of the spectrum for public safety communications. The initial pilot plan had included this test on the "live" broadband pilot network. However, licensing and the constricted pilot timetable precluded performing the "live" test.

As public safety partners, GRE believed its contribution to an eventual public safety broadband network wouldn't necessarily stop there. It also could contribute a number of assets valuable to the deployment and operation of a broadband network--experience in handling large-capital projects, deep IT experience, communication tower space, and substation properties as possible network sites.

"We viewed the pilot as a chance for public safety agencies and utilities to view each other differently," said Kathy Nelson, principal telecommunications engineer for GRE. "Public safety and utilities share the common mission of saving lives and property. Without power, rescue and restoration work is significantly compromised. We wanted to demonstrate that with a small amount of spectrum on the public safety broadband network and a guaranteed bitrate for our most critical needs, we could maintain power services even in the most challenging circumstances and not impact public safety's communications requirements."



Kathy Nelson, principal telecommunications engineer at GRE, watches broadband communications traffic and streaming video on a laptop during the pilot's Functional Exercise in November. Nelson was a member of the team that designed the public/private pilot.

Brett Kilbourne, vice president of Government and Industry Affairs and deputy general counsel for the Utilities Telecom Council, thought participating in the pilot could open some promising options for utilities and public safety:

"From a national perspective, we viewed the Minnesota pilot project as a first step in defining public safety agencies and utilities as public safety communications partners. The test could demonstrate how both could share a common resource without compromising the mission of either. As potential system users, we also believe utilities could provide significant financial help that could ensure that the broadband network is economically sustainable."

The Pilot Design

With the public/private pilot vision defined, work quickly shifted to formalizing the pilot's structure from mission to test components.

The Mission

The mission had four elements:

- Demonstrate and evaluate a public/private partnership in a "live" public safety broadband network.
- Collect design, deployment and performance information that could be provided to FirstNet as part of the state's ongoing consultation with the authority.
- Enable public safety agencies in suburban and rural areas of Minnesota to experience the benefits of public safety broadband LTE. This could generate considerable support for FirstNet nationally as well as the network's future deployment within the state.
- Perform technical evaluations of currently available public safety-grade Band 14 LTE equipment.

Sophisticated tablets and smartphones running public safety software were communications tools used by participants in the pilot's Functional Exercise this past November.

Supporting Goals

This mission led to a number of specific goals:

- Identify and begin working through governance issues to ensure a smooth future broadband network rollout and ongoing operation statewide.
- Secure private stakeholders to provide the necessary pilot system hardware, software and technical support.
- Test the network's ability to prioritize communications traffic, deliver and manage necessary coverage, accommodate public safety-specific applications, provide roaming support, and deliver a guaranteed bitrate for crucial utility functions.

The Location

The state selected Elk River as the site of the pilot test. The small community of some 22,000 residents about 35 northwest of Minneapolis provided a suburban environment that touched on rural areas as well. This was in marked contrast to the sites of many previous public safety broadband pilots across the country to date—Harris County, Texas (Houston), with an area population of 4.34 million, LA-RICS, serving a population of more than 10 million, and Adams County, Colo. (Denver), with a population of 469,000.

Fire Chief John Cunningham of Elk River, Minn. helps participant in the pilot's functional exercise. It was the first time they had had the opportunity to use broadband hardware on a "live" broadband network.

The interest, commitment and skilled support of Elk River's Fire Department and its fire chief, John Cunningham, ensured that each pilot activity unfolded efficiently.

The Stakeholders

Public stakeholders not only included ECN, but also the Minnesota Statewide Emergency Communications Board (SECB). The SECB includes 20 government and public safety officials representing counties and cities statewide. The SECB provides governance for interoperable communications in the state, including the potential adoption and implementation of the Nationwide Public Safety Broadband Network.

ECN added a number of private stakeholders who agreed to provide equipment technical support and other expertise for the pilot. These companies provided their support at no charge to the state.

The Industry Day event included presentations by pilot stakeholders, including companies that provided equipment and technical support to the pilot.

- **NewCore Wireless** provided hosted switching services for the eNodeB and Band 14 devices as well as technical expertise.
- **Great River Energy** provided a system antenna site and backhaul equipment for the network's LTE core.
- **Motorola Solutions,** a provider of communications devices and applications for government and public safety agencies and enterprises worldwide, contributed the eNodeB for the test as well as communications devices, software and technical expertise.

Dan Naylor (left), Product Manager for Motorola Solutions, talks about the features and applications of the company's vehicular modems and handheld devices that were used in the pilot.

- **The City of Elk River**, and particularly its fire department, hosted the entire pilot exercise.

- **Sonim Technologies,** a provider of ultra-rugged, water-submersible mobile phones designed specifically for public safety and other demanding and hazardous environments, provided smartphones for the pilot.
- **Lociva** provides deployable 4G LTE mobile network systems designed specifically for public safety and tactical use.

The Pilot Scope

The scope of the pilot included three individual exercises on three separate days: a Tabletop Exercise with a focus on the use of broadband communications, an Industry Day event that showcased broadband equipment provided by pilot stakeholders, and a Functional Exercise in which participants had the opportunity to use equipment on a "live" broadband network.

"The pilot was designed to provide participants with complete broadband experience," says Chief Cunningham. "There was an opportunity to learn about broadband generally, talk with broadband equipment providers and see actual equipment, and then put broadband to use."

Pilot Implementation

With the final design of the pilot exercises complete, the pilot began in August 2015.

Tabletop Exercise

The first exercise was the Tabletop. Seventy-two public safety professionals from 43 agencies and organizations participated. All participants were organized by discipline — police, fire, tribal groups, and military, among others — and by function, such as PSAP and dispatch. The exercise was conducted and facilitated by experts from the U.S. Department of Homeland Security, Office of Emergency Communications (OEC), and Interoperable Communications Technical Assistance Program (ICTAP).

Through the exercise, participants learned to untether their thinking from the communication approaches they were accustomed to using with their land mobile radio systems.

OEC tightly defined the exercise:

1. The incident: A vehicle hit a commuter train, causing a derailment.
2. The emergency required a multi-agency response.
3. Dedicated public safety communications systems were available.
4. Cellular networks were down.
5. The task: Identify communications needs and determine how best to use available mission-critical public safety broadband communications throughout the incident.

Following the exercise, OEC offered many recommendations for all to consider. Those recommendations fell into a number of major categories.

1. **Build local support**. Successful adoption and application of broadband requires building awareness and deep understanding within every agency involved.
2. **Identify and define specific local needs clearly**. Agency broadband communications needs must be thoroughly researched and continually monitored to ensure that the communications tools available meet those needs.
3. **Specify governance.** A smooth transition to and effective ongoing management of broadband require a thoroughly defined governance structure and protocol.
4. **Pay particular attention to staffing and training.** Broadband will require different staffing, with professionals skilled in working with highly sophisticated and complex IT technology and systems. Considering the speed with which technology changes, constant training also will be vital.

Industry Day

Industry Day was a broadband equipment-focused event held immediately following a regularly scheduled SECB meeting in October.

The event included formal presentations from stakeholders involved in the pilot. They described the hardware systems, software, and devices they provided for the pilot and

the progress made on the pilot's implementation to date. Together, this helped enhance the SECB's understanding of the capabilities and benefits of broadband generally and helped the state enhance the SECB's support for an eventual broadband deployment statewide.

The Minnesota Statewide Emergency Communication Board reeives updates on pilot progress at its October 2015 meeting. The meeting included an Industry Day showcase of hardware and software used in the pilot.

Following the presentations, SECB members and others attending the showcase had an opportunity to view broadband hardware and talk personally with equipment providers. Equipment on display ranged from sophisticated public safety-grade smartphones to portable networking devices and even radio-controlled aerial drones. NewCore Wireless displayed an antenna, a digital unit and radio hardware used in the pilot. Together, these enabled data services and Internet access as part of its LTE core.

"One of the things we confirmed in the pilot was that public safety needs a dedicated broadband network for maximum benefit," says NewCore's Kangas. "Uninterrupted communications in emergencies of all descriptions is vital. It also was clear to us that local agency buy-in would be crucial to the success of a future broadband network. And, since cost always is a factor, it was obvious that everyone involved would have to make sure that all of the state's assets and taxpayer funding are used thoughtfully and efficiently."

A panel provided the SECB exercise and equipment details at its October meeting. The panel included (from left) Albert Kangas, NewCore Wireless chief operating officer and general manager; Stephanie Court, NewCore Wireless director of business operations; Mike Koch, Motorola Solutions; Katherine Shaft, Great River Energy telecommunications engineer; John Cunningham, Elk River, Minn. fire chief, host for the pilot; Brandon Abley, Televate pilot manager; and Jackie Mines, Minnesota ECN division director.

Motorola Solutions demonstrated a number of Android-based devices, including its VML 750 LTE vehicular modems, LEX 10 series LTE handheld devices and WAVE PTT technology.

The VML 750 LTE modems connect vehicle-installed hardware to a public safety LTE network. The LEX L10 Mission Critical LTE handhelds connect to an LTE network delivering mission-critical capabilities not available on consumer-grade smartphones. The WAVE Mobile Communicator turns an Android handheld device into a multi-channel, push-to-talk (PTT) handset for fully secure, real-time PTT voice communications anywhere a network connection exists.

"With the pilot, we wanted to demonstrate that broadband is a powerful communications enabler, but also that the devices that can be used in these systems are available now," says Fred Chavis, senior manager of Public Safety LTE Trials and Demonstrations for Motorola Solutions. "The pilot also provided us the opportunity to demonstrate that public/private spectrum sharing partnerships can work. We were able to demonstrate in our laboratories that Great River Energy could be provided a small amount of public safety spectrum and a guaranteed bitrate for vital functions without compromising public safety's priority access to this spectrum."

Sonim Technologies demonstrated its sophisticated, Android-based XP7 smartphone. The Sonim XP7 smartphone is FirstNet network compatible and equipped to operate on both commercial and 700 MHz Band class 14 LTE wireless spectrum. Its design includes a long list of features that make it well-suited to the demands of the public safety environment — long battery life, a touch screen that's viewable even in direct sunlight, a keyboard that can be used with a gloved hand, and resistance to environmental challenges ranging from water and heat to temperature and oil/chemical exposure.

Robert Escalle, Sonim Technologies vice president of the Public Safety Market Segment, describes some of the features and capabilities of the company's sophisticated XP7 smartphones that participants in the pilot's Functional Exercise in November used.

"The equipment presentations and one-on-one discussions during the Industry Day showcase were especially important because so many in public safety don't fully

understand broadband technology and the many devices that can operate on these networks," says Robert Escalle, Sonim's vice president, Public Safety Market Segment.

"Informational and educational opportunities like this pilot enable broadband providers to bring the whole concept closer to public safety users."

Lociva demonstrated its mission-critical deployable 4G LTE systems. Its MicroNET micro-cell will support as many as 400 simultaneous users up to a range of 60 kilometers. The Little Wolf vehicle-based deployable LTE network will accommodate as many as 128 users and multiple RF bands with an embedded ECX 4G LTE network core and built-in backhaul/meshing.

Paul Christoforou, president of Lociva, talks about the importance of deployable networks as part of a comprehensive broadband network plan. Lociva showcased several of its deployable systems at the Industry Day event.

"We wanted to demonstrate that our mission-critical deployable LTE networks make it possible for public safety agencies to literally take their broadband networks with them anywhere," says Paul Christoforou, Lociva president. "An agency does not need to feel tethered to the range of a fixed site. They can think of these deployable systems as a 'cellular network in box.' Some are as small as a briefcase and can be placed in any public safety vehicle and deployed to provide coverage for multiple events in any number necessary."

NMOTION displayed its Unmanned Aerial Systems (UAS). The Hesston, Kan.-based provider used some of those drones during the Functional Exercise in November. Exercise participants had the opportunity to operate and view them in flight.

Functional Exercise

The Functional Exercise completed the pilot's broadband experience. Dozens of agencies participated in the exercise. Technical support and mobile command centers were provided by the City of St. Cloud and Washington, Douglas and Sherburne counties. There were four mobile units-- Field Personnel, Dispatch, Emergency Operations Center and Incident Command Post. Washington County also provided a Band 14 vehicular modem with Wi-Fi hotspot. This enabled Internet service to laptops at the Incident Command Post.

Douglas County, Minn., was one of three counties that provided mobile command centers for the Functional Exercise. The others were Sherburne and Washington counties. The City of St. Cloud also provided a command center.

The Functional Exercise used a scavenger-hunt theme. The scenario was that there had been the threat of attack somewhere in the Elk River area. The communications tools available for participants to use to respond included Push-To-Talk voice communications over the LTE network, streaming video from body-worn cameras, streaming video from unmanned aerial drones, email and CAD messaging. Participants used these devices to discover and follow clues that helped them respond and resolve the emergency. Everyone also had the opportunity to observe voice, data and streaming video transmissions monitored in the four mobile operation centers.

"This exercise pulled everything together," says Chief Cunningham. "We wanted to provide an experience that everyone would relate to. The only difference was that the

only communications tool anyone could use was broadband over the 'live' Band 14 network."

For many involved in the exercise, using only the broadband system was a challenge.

"When you are using a system that you don't fully understand or that you may have never used, you find out quickly that you 'don't know what you don't know,'" adds Chief Cunningham. "But I believe that everyone involved in the Functional Exercise came away with a lot of new knowledge they will put to good use as dedicated broadband networks become available."

Aerial drones provided pilot participants a unique view of the Functional Exercise venue. Participants had the opportunity to view and fly the drones for themselves.

Recommendations for the Future

For everyone involved in the pilot, the experience crystalized a number of recommendations for the future of broadband statewide:

- **Develop and support an effective governance structure**. Minnesota's success with public safety communications is built on its robust, broadly representative and collaborative public safety communications governance structure. The SECB's leadership in this pilot provided the program with the legitimacy to secure the stakeholder support it needed. The governance structure will be similarly critical to the rollout and adoption of a statewide public safety network.
- **Work closely with communications manufacturers.** Given the development cycle for new broadband devices and networking systems, public safety users and communications manufacturers need to work together more closely and earlier in the developmental cycle. This will ensure that the equipment and software that are ultimately available will effectively match user needs.
- **Develop a comprehensive IT staffing approach.** Staffing and training will put different and difficult pressures on agencies. Staffing broadband networks will require searching for personnel with specific and extensive IT expertise. With the speed of technological change, a comprehensive training plan will be vital, too.

Broadband responsibilities should not simply be added to the heavy workloads of already challenged PSAP and dispatch personnel.

- **Create a plan for data management.** This plan will require disciplined execution. Broadband will enable the capture of enormous amounts of data. This will raise considerable governance, legal, policy, organizing and use issues that must be addressed.

There also was consensus on recommendations for states and communities interested in performing some broadband testing for themselves.

- **Be sure to build an educational component into the pilot.** Although many first responders may be familiar with the idea of broadband networks, their knowledge may not extend much beyond that. The whole concept and its use in public safety is in its infancy. Agencies must not forget to target the public, too. Their support will be invaluable in adopting, deploying, paying for and using the broadband network.
- **Test equipment and software to be used in the pilot before beginning.** Equipment and software malfunctions are always possible, and if they occur, they can interfere with achieving a pilot's goals. Be sure all hardware and software is ready for use.

- **Secure required licensing as far in advance as possible.** The process to secure required licenses can be lengthy, often longer than expected.
- **Establish realistic pilot goals, create a tightly written scope of work, and set a realistic timeline with deadlines that will ensure that pilot goals are achieved.** As always, planning is everything.

Communications traffic, including video streams from aerial drones and body cameras, was monitored in the Functional Exercise command centers.

Some Final Thoughts

Understanding the communications needs of both fellow public safety agencies and potential private partners in a shared broadband network will take time. A high level of understanding is the foundation for creating a robust broadband network and the

collaborative environment in which public safety and critical infrastructure partners can respond seamlessly together in emergencies.

"This pilot has been successful in starting the broadband conversation between public safety agencies and electric utilities," says Kathy Nelson of GRE. "But gaining a consensus and support for a broader concept of public safety and resource sharing for communications purposes is a long-term undertaking."

The time for public safety departments to begin developing a broadband plan is now. Accommodating new technologies always takes more time than one thinks. The transition to P25 digital standards and equipment for land mobile radio is a prime example. Broadband equipment is already here. The networks on which departments will use these devices may be available more quickly than many imagine.

"One of the major objectives we accomplished with this pilot was to create a 'sandbox' in which everyone with a stake in broadband could explore options together," says Chief Cunningham. "This type of experience always delivers the best and often surprising results."

This pilot was an intense experience for everyone. But all agreed that much had been achieved in a short timeframe. Many said that they were surprised that the pilot accomplished so much.

"I was pleased to see that everyone was around the table contributing, learning, understanding and working hard with each other to figure out how best to implement broadband networks," says Dunaski. "We know that success in designing and deploying these systems will depend on opening lines of communication. It's all about personal relationships, involvement and commitment. And, I believe this pilot demonstrated that public safety in Minnesota is ready to move forward."

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