

An Incremental Approach to Public Safety Communications Interoperability

Moving Toward a Nationwide Public Safety Broadband Network

The stated long-term goal of the Federal Government is to create a nationwide, interoperable 700 MHz broadband wireless network for public safety. This network will have wide coverage, use common protocols, and allow cost reductions through economies of scale in acquiring mobile equipment. The network's structure will provide horizontal intercommunication (e.g., between municipalities) and vertical intercommunication (e.g., among municipalities, states, and federal entities). In addition, the network will allow emergency responders to cross jurisdictional boundaries without losing voice and data capabilities.

An interoperable public safety network is an outcome greatly to be wished, and any public safety data application must be designed with the eventual deployment of this proposed system in mind. Unfortunately, the Federal Government has yet to decide the final form and method of implementation for the nationwide Public Safety Broadband Network (PSBN). The time frame for selection of the final form remains an open question, although it is likely that the Federal Communications Commission will soon examine and modify existing rules to govern a future nationwide PSBN. Once these new rules are adopted, a new auction for a 700 MHz nationwide PSBN license will not likely occur until late 2008 at the earliest, and the construction and launching of a nationwide PSBN will surely require considerable additional time even if such PSBN license is awarded by year's end.

Waiting won't address the problems currently faced by first responders. On the other hand, spending money on an interim solution that will be obviated by a nationwide network is hard to justify when there are so many other pressing needs.

The best solution is to find ways to progress toward vertical and horizontal interoperability quickly, with immediate benefit. It is of utmost importance to implement a design that will not become obsolete when the nationwide network is a reality. The infrastructures of the interim and the nationwide solution should mesh and augment one another.

GEOCommand, in partnership with **CX2 Technologies**, offers technology that precisely supports this multi-phase, integrated approach.

Phased Implementation

Implementation costs should be incremental, with demonstrable gains at each stage. We believe that public safety entities can make quick, cost-effective strides toward interoperability by combining data sharing with an inexpensive wireless network.

We'll address the **GEOCommand** data-sharing solution first, followed by a description of the unique **CX2** wireless architecture.

Data Sharing

Nearly every community has an existing plan for dealing with emergencies. These plans may reside in special purpose record management systems, in other computer file structures, or on paper. Across and within jurisdictions, the plans may differ significantly both in their level of detail and in the form in which they are stored.

These plans can be of limited utility in an environment of shared access. The value of maps, pictures, floor plans, etc., is obvious, but sharing these large data sets requires considerable bandwidth. Until the PSBN is built, the wireless connectivity required to share these data sets will be available in very few areas. As a result, emergency plan information must reside on each field terminal on a stand-alone basis, in the same format and version.

GEOCommand

GEOCommand provides easy-to-use tools for standardizing plan formats. The software's intuitive interface makes the transition to more accessible and better organized emergency response plans straightforward. The ease of entering information also encourages archiving the knowledge of key personnel, ensuring that this knowledge is available to others on demand.

GEOCommand Components

The GEOCommand emergency information system consists of (1) an Administration Module, which is used to author and update the database; (2) Mobile Modules, which are used in the field; and, where applicable, (3) the GEOCommand Dynamic Server, which brokers real-time information from, for example, weather stations and fixed or mobile sensors. The Administration and Mobile Modules, together with a Geographic Information System (GIS) engine and the emergency response preplan database, provide responders with the best possible situational awareness en route or at the site of an emergency.

GIS and Data Sets

GEOCommand was developed to leverage existing GIS data sets that are freely available across the nation. Common map data maintained by local governments includes building footprints, aerial photography, and utility network data. This currently available map data instantly provides responders with a detailed graphic representation of an incident site. The responder can select an individual map feature for more information. For example, clicking a hydrant on the map displays the hydrant's status and flow rate, critical information at the scene of a fire.

Data Entry and Import

In addition to existing GIS data sets, GEOCommand users can enter site contact information, hazards, building construction details, and digital photos, and can scan existing paper documents into the system. GEOCommand is also able to automatically import electronic record management data from legacy systems. Imported emergency

data can be referenced by address or name (e.g., “Walker Elementary School”) or accessed by clicking on a map location. The software’s flexible structure can accommodate data from other departments and organizations, and the configurable preplans organize and display any amount of critical data.

GEOCommand’s data and planning capabilities have immediate benefits while simultaneously allowing the organization to make long-term preparations for major incidents.

Scalability

GEOCommand’s scalable software offers value in any implementation, whether the organization chooses to install the software on a single desktop or on hundreds of mobile computers. The database resides on one computer, the Administration Module, or on a shared, dedicated network storage device such as a file server, which is generally located at the command center. Mobile Modules (in-vehicle computers) manually or automatically update map and preplan information, ensuring that the data on all Modules remains synchronized.

Uninterrupted Data Availability

Each GEOCommand Module makes map and preplan data available in the field *regardless of connectivity*. Some emergency response software packages use a Web-based scheme that does not work when connectivity is compromised, a common occurrence in major incidents. With these systems, data is often inaccessible precisely when it is needed most. Because GEOCommand’s Mobile Modules can operate independently of the Administration Module, data availability remains uncompromised.

Sensor and Real-Time Data

Wireless connectivity, although not necessary, is an enhancement to GEOCommand’s capabilities. It allows current data to be moved not just to the command center, but to the field. The GEOCommand Dynamic Server™ brokers data from a variety of sources and forwards it as directed. The Dynamic Server is designed to interface with a wide variety of data networks, both wired and wireless. It is designed to be flexible and to scale to network expansions without requiring reinstallation or upgrades. This inherent expandability brings us to the second part of our solution.

CX2 Technologies

CX2 is the only company in the world to have developed a narrowband wireless data solution at 220 MHz. The solution’s advantages are spectrum efficiency, extraordinary coverage footprint, readily available dedicated public safety spectrum, and generally interference-free operation. The limitation is that its 5 kHz bandwidth is not suited to transferring large data packets. Nevertheless, the bandwidth serves extremely well for dispatch, vehicle location, remote sensor monitoring, and other short message applications.

A wide area network reserved for these vital functions would have an important impact on interoperable public safety communications. After the PSBN or other broadband network is built out, the CX2 220 MHz network could be used in conjunction with the PSBN to relay sensor data only. The CX2 network would ensure that sensor data keeps

flowing during times of heavy broadband loading, allowing continued vigilance even under the intense conditions of a large-scale terrorist attack or catastrophic natural disaster.

Reliability and Redundancy

The coverage footprint at VHF (1200 square miles is common) makes large area build-outs practical. The system is extremely reliable as is, and redundancy options are available at several levels. The system is also secure over the air, with built-in encoding and a patented proprietary protocol. The interface from the base station up is IP-based, and data can travel over secured private networks. Data routing is user configurable.

Base Stations

CX2 base stations are FCC type accepted. They are designed to operate autonomously in conjunction with CX2's Local Site Server (LSS) software. One LSS can control 35 base stations. Transmitters can be de-keyed and keyed remotely. Loss of contact with control software results in automatic rerouting of connected modems, which can be configured for de-key or broadcast warning. Interval call sign broadcast is automatic.

Data Modems

CX2's DATAlynx™ radio modems operate on 12-18 VDC and are built for difficult environments. These modems have operated in diverse locations, ranging from natural gas fields in southern Texas to bulldozer cabins in northern Illinois. They require no user input, connect to the network automatically, and switch base stations as needed. The modems are equipped with an integral GPS receiver and an onboard computer chip running embedded Automatic Vehicle Location code.

CX2 offers network planning, installation, integration, and testing as a normal part of its service. Interface to GEOCommand is preconfigured and automatic. The system is designed to be turnkey and maintenance free.

About GEOCommand and CX2

GEOCommand

GEOCommand is a software development and systems integration company headquartered in Boca Raton, Florida. The company developed its advanced and intuitive mobile emergency response applications to provide critical information to first responders en route or on site at an emergency.

GEOCommand draws on the talents of an unparalleled team of experts in Geographic Information System (GIS) design and analysis; real-time data acquisition and control systems; wireless technologies; radio spectrum analysis and deployment; software development; and emergency response solutions.

The GEOCommand suite of applications offers:

- ◆ Mobile mapping (ESRI ArcGIS 9.2)
- ◆ User-specified map source data
- ◆ Situational and preplan data sets
- ◆ Aerial photographs and satellite source images

- ◆ Cross-referenced emergency handbooks
- ◆ Automatic routing functionality
- ◆ Multi-jurisdictional data sharing and communications interoperability

GEOCommand integrates with:

- ◆ Computer-Aided Dispatch (CAD) communications and supportive data
- ◆ GPS-equipped radios
- ◆ Stand-alone GPS units
- ◆ Field-deployed sensing devices (e.g., weather, radiation)
- ◆ Firehouse and other EOC software solutions
- ◆ Pictometry and TeleAtlas

CX2 Technologies

CX2 Technologies is a 220 MHz wireless network developer also located in Boca Raton. CX2's DATAlynx digital radios use a patented over-the-air protocol to tap the largely unused potential of this band. The company's spectrum-efficient use of 5 kHz channels represents a quickly deployable, relatively inexpensive method to gain critical wireless data capabilities for public safety and emergency response organizations.

Conclusion and Recommendations

Any public safety communications application must be designed with the eventual deployment of the proposed nationwide Public Safety Broadband Network (PSBN) in mind. It is of utmost importance to implement a network and data sharing design that will not become obsolete when the nationwide network is a reality.

We believe that public safety entities can make quick, cost-effective strides toward interoperability by combining data sharing with an inexpensive wireless network.

GEOCommand, in partnership with **CX2 Technologies**, offers technology that supports a multi-phase, integrated approach.

Step 1. A Scalable, Cost-Effective Data Sharing Solution

Public safety entities can begin the transition to communications interoperability by implementing the GEOCommand mobile emergency response solution, which operates with any network configuration and legacy equipment. GEOCommand allows first responders to access critical information in the field, even when wired or wireless communications are unavailable, and makes it possible to share information across jurisdictional boundaries. GEOCommand's mapping, GPS, site pre-plan, and data sharing capabilities have immediate benefits while simultaneously allowing public safety organizations to make long-term preparations for major incidents.

Step 2. A Scalable, Flexible Data Network Server

With the addition of the GEOCommand Dynamic Server, public safety entities can incorporate real-time data from weather stations, sensor networks, and, when available, in-building video feeds. The Dynamic Server is designed to interface with a wide variety of data networks, both wired and wireless, and scales to any network expansion.

Step 3. A Robust, Efficient Narrowband Network

We recommend that public safety entities examine the currently underutilized and extraordinarily efficient 220 MHz narrowband frequency, which serves extremely well for dispatch, vehicle location, remote sensor monitoring, and other short message applications. CX2 is the only company in the world to have developed a narrowband wireless data solution at 220 MHz. The solution's advantages include its extraordinary coverage footprint (up to 1200 square miles), readily available dedicated public safety spectrum, and generally interference-free operation. Interface to the GEOCommand Dynamic Server is preconfigured and automatic, and the CX2 system is designed to be turnkey and maintenance free.

Step 4. Transition to the Nationwide PSBN

After the PSBN or other broadband network is built out, the 220 MHz CX2 network could be limited to relaying sensor data only. The continued use of this narrowband network would reliably ensure that sensor data keeps flowing during times of heavy broadband loading, allowing continued vigilance even under the intense conditions of a large-scale terrorist attack or natural disaster. GEOCommand's critical data and mapping solution is inherently expandable, and is designed to integrate with the nationwide PSBN without reinstallation or upgrades.

Public safety entities employing the combined GEOCommand and CX2 solutions are ideally positioned to transition to a nationwide PSBN without costly equipment upgrades or labor-intensive data entry and conversion requirements.