PUBLIC SAFETY

PSWN PROGRAM

WIRELESS NETWORK

Saving Lives and Property Through Improved Interoperability

Maryland Public Safety Communications Post-Symposium Report

Final

November 2001

FOREWORD

The Maryland Public Safety Communications Symposium, sponsored by the Public Safety Wireless Network (PSWN) Program, was held on September 19, 2001, in Annapolis, Maryland. Booz Allen fulfilled all of the general symposium and facility requirements, ensured that all attendees were registered on site, monitored sign-in, and distributed preconference materials. Booz Allen also assisted with overall presentation support, including managing each speaker's time. All PSWN Program equipment and unused symposium materials were transported back to the PSWN Program Technical Resource Center (TRC) after the symposium. This document describes the key themes discussed during the symposium and includes the final attendance list. The final report will be posted on the PSWN Program Web site. Interested parties can download the report or call 1-800-565-PSWN and request a copy of the document.

TABLE OF CONTENTS

1. INTRODUCTION

The Public Safety Wireless Network (PSWN) Program sponsored the Maryland Public Safety Communications Symposium on September 19, 2001. The Maryland State Police (MSP) hosted the symposium, which took place in Annapolis, Maryland. Previously, the PSWN Program has sponsored similar symposiums in Charlotte, North Carolina; Harrisburg, Pennsylvania; Sacramento, California; Boston, Massachusetts; Chicago, Illinois; Mesa, Arizona; Denver, Colorado; Lansing, Michigan; Orlando, Florida; St. Louis, Missouri; Honolulu, Hawaii; Boise, Idaho; and Minneapolis, Minnesota. The program has also sponsored a mini-symposium in Washington, DC. The purpose of these events has been to discuss issues related to the interoperability of public safety land mobile radio (LMR) communications and public safety shared systems. This particular event was unique to the PSWN Program in that it was the first one-day symposium sponsored by the program that targeted state-specific issues. The PSWN Program is using one-day events like this one to specifically help state public safety leaders get their message about their communications efforts out to state decision makers.

At the Maryland Public Safety Communications Symposium, 97 public safety officials from the Maryland region assembled to discuss various topics relating to public safety wireless communications interoperability in the State of Maryland and surrounding areas. MSP Major Greg Shipley and the Superintendent of the Maryland State Police, Colonel David Mitchell, provided introductory remarks and the keynote address. During their comments, each acknowledged regional cooperation, national awareness, and interoperability as essential for protection of life and safety of citizens and public safety personnel. Additionally, Colonel Mitchell advised attendees to work together, share experiences, and take away newfound knowledge in hopes of improving interoperability in Maryland.

Following the keynote remarks, attendees were briefed on the PSWN Program and its overall goals and objectives. The speakers then discussed the key technical and policy issues critical to improving wireless interoperability and attendees were able to question public safety representatives about the current state of their respective systems' development.

1.1 Purpose

This report provides a detailed summary of the events of the Maryland Public Safety Communications Symposium. It is designed to be a historical resource for those who attended the symposium and to provide a broad overview for those who were unable to attend. In general, this symposium report highlights—

- Key themes the presentations and panel supported
- Interoperability challenges and success stories discussed throughout the symposium
- Important facts and information provided to the audience
- Answers to questions of interest asked during the symposium.

This document is organized according to the major topic areas presented at the symposium. Within each section, the key themes that emerged from consideration of a specific topic are provided and thoroughly explained using information presented during briefings and provided in response to questions asked during topic sessions.

2. SYMPOSIUM TOPICS

The Maryland Public Safety Communications Symposium was organized into several topic areas. Each of the topic areas included presentations from various people, ranging from members of the public safety community to PSWN Program representatives. A panel of experienced public safety officials, who answered questions from the audience, addressed one topic. The topics were selected to give the symposium attendees a perspective on the PSWN Program and the state of interoperability within Maryland and the surrounding region. The symposium covered the following topics:

- The State of Interoperability in Maryland
- Fostering Collaboration
- Interoperability as a Mission-Critical Function
- Successful Models

Over the course of the event, several key themes emerged via the presentation given as part of that topic. In the following sections, each topic and the related themes are presented. The themes are supported by the remarks of the presenters and panelists.

2.1 The State of Interoperability in Maryland

The State of Maryland has been working toward the goal of creating a seamless, statewide public safety radio system. For the past several years, these efforts have focused on the consolidation of towers and the installation of infrastructure for future use. The state is making a concerted effort to work in partnership with local and regional governments throughout the process to achieve wide-area interoperability. During the symposium, participants got a national perspective on interoperability as well as a vision of interoperability planning in Maryland.

The PSWN Program and Interoperability

The PSWN Program envisions seamless, coordinated, and integrated public safety communications for the safe, effective, and efficient protection of life and property. Specifically, the program focuses on improving wireless interoperability among public safety entities at all levels of government. The PSWN Program is a federally funded program, jointly sponsored by the Department of Justice (DOJ) and the Department of the Treasury (Treasury). The program works in partnership with local and state public safety agencies to improve interoperability.

The PSWN Program is divided into two phases. Phase I, PSWN Implementation Planning, takes place from fiscal year (FY) 1997 through FY 2001. During Phase I, the PSWN Program performed an integrated set of studies and evaluations of existing public safety wireless interoperability systems and developed pilot projects. These activities resulted in a knowledge base known as Public Safety WINS: Wireless Interoperability National Strategy.

Public Safety WINS is the capstone product of the program's efforts during Phase I and presents the program's strategy for improving interoperability throughout the Nation. Public Safety WINS will serve as an information baseline for the program as it begins to offer interoperability services to local, state, and federal public safety entities. Public Safety WINS is being developed as a multimedia package that includes a video and CD-ROM. The video portion of Public Safety WINS was shown at the beginning of the symposium.

Currently, Phase II of the program, PSWN Interoperability Assistance, offers a suite of services that assist the public safety community in executing Public Safety WINS. These services include providing an information clearinghouse and offering interoperability assistance to public safety agencies with specific interoperability issues. Phase II takes place from FY 2002 through FY 2006.

The PSWN Program is active in five key issue areas that must be addressed to improve interoperability. The issue areas, and how the PSWN Program is addressing them, are highlighted below.

- **Coordination and partnerships**. Improved coordination and partnerships within the public safety community are critical to improving interoperability. In an effort to facilitate new partnerships, the PSWN Program has provided briefings at annual conferences of national public safety associations. The program also hosts regional symposiums to bring together public safety officials to share their ideas and experiences with others. Additionally, the program and the National Institute of Justice will co-host a National Interoperability Forum this fall that will gather state decision makers, elected and appointed officials, and public safety executives to encourage the policy community to initiate or continue steps to improve interoperability.

- **Funding**. Limited funding for communications is a major issue faced by the public safety community. The program has developed reports and guides that highlight the issues related to upgrading and replacing public safety wireless systems and discuss sound funding strategies for the life cycle of a communications system.

- **Spectrum**. The PSWN Program recognizes that spectrum is a limited resource. The program is supporting efforts to acquire more spectrum for public safety and to enact rulings that flexibly allow interoperability.

- **Standards and technology**. The development of standards and open-systems architectures is a key issue that must be addressed to make progress toward improved interoperability. The program partnered with the Criminal Justice Information Services Division of the Federal Bureau of Investigation (FBI) to assess the integration feasibility of National Crime Information Center (NCIC) 2000 through its Wireless Applications Test Program of hardware and software.

- **Security**. To ensure that its communications systems are secure, the public safety community needs to incorporate both physical and system security measures so that public safety agencies can effectively and efficiently carry out their critical

operations. The PSWN Program is developing recommended security guidelines for digital LMR systems, and is building security policy and security planning templates to assist radio managers in designing their system security policies and procedures.

The PSWN Program is also working with local, state, and federal entities to conduct interoperability pilots throughout the Nation. These pilot projects allow the PSWN Program to demonstrate interoperability solutions on active systems. The program hopes that these pilots will help initiate future development of interoperable systems. Pilot projects are under way in Salt Lake City, Utah; along the Southwest border; along the Vermont/New Hampshire border; in South Florida; and in Washington, DC. In addition, the program is assisting the State of Montana and has recently completed a pilot project in San Diego, California. These pilot projects were discussed briefly during the symposium. Brief descriptions of the pilot activities are provided below:

Southwest Border. The PSWN Program is conducting end-to-end tests of the pilot solution in Las Cruces, New Mexico, and El Paso, Texas. This pilot provides a unique solution for interoperability between proprietary trunked systems. The PSWN Program is implementing a fixed site talk-group-to-talk-group or conventional-channel-to-talk-group interoperability link that will allow subscriber units in one city to talk to subscriber units in another.

Montana. The PSWN Program has completed work with the State of Montana and its Public Safety Communications Council to develop a consolidated radio site that several entities (i.e., local, state, and federal) will share within the state. It is envisioned that the site can be a model for developing shared use sites and that lessons learned from this process can be applied to similar sites statewide. Participants on the shared site include the Montana Department of Transportation, Montana Department of Justice, Montana Highway Patrol, Montana State Lands, Carbon County, Bureau of Land Management, U.S. Forest Service, and the FBI**.** Under this program, several public safety agencies' equipment have been collocated at a single site. To facilitate that occurrence, the PSWN Program issued requests for quotation and procurement to vendors for the collocation effort and monitored the construction of the collocation tower.

Washington, DC. The PSWN Program selected a pilot technical solution for providing interoperability in the Washington, DC, area. The solution implements tri-band (i.e., very high frequency [VHF], ultra high frequency [UHF], and 800 megahertz [MHz]) repeater stacks at six traffic choke points around the DC area "Beltway" and ties these repeaters into an interconnected network of local 800 MHz systems. The pilot involves a large federal presence and addresses the challenges of bringing together many different radio networks and systems operating in different bands.

Salt Lake City. The PSWN Program is supporting the Utah Communications Agency Network in Salt Lake City. Specifically, the program is working to develop a software solution to connect two 800 MHz systems in the Salt Lake City area. The solution links the two systems using Motorola's Omnilink product to provide seamless roaming over a contiguous area. The pilot is also exploring the use of shared talk groups to improve interoperability among federal

agencies in the area. Additionally, the intention is to support critical, interoperable communications during the 2002 Winter Olympic Games and into the future.

Vermont/New Hampshire State Interoperability Assistance. The PSWN Program supported public safety representatives in Vermont and New Hampshire in designing and implementing a cross-border interoperability solution. The proposed solution involves installing VHF radios with microwave interconnects in Vermont to achieve interoperability with New Hampshire.

Maritime Case Study. The PSWN Program developed an action plan and pilot strategy for improving public safety communications in southeast Louisiana. The strategy and plan were based on the results of a case study of public safety communications in the area and discussions with public safety leaders in Louisiana. The program is examining several options as part of the pilot, including developing a regional maritime wireless interoperability strategy, implementing a VHF-to-800 MHz link, implementing a console-to-console link, conducting a mobile command post upgrade, and developing a regional maritime wireless data strategy.

The Native American Tribal Nations Interoperability Assessment. The PSWN Program met with representatives of the Bureau of Indian Affairs and the National Park Service to coordinate planning activities. This project will explore the unique communications and interoperability challenges facing tribal nations when interacting with local, state, federal, and other tribal public safety agencies.

South Florida Pilot. The PSWN Program performed field tests and coordinated activities associated with resolving end-to-end system test failures. This pilot demonstrates quick system implementation of a discrete, short-term interoperability solution for local, state, and federal users in different frequency bands. A fixed solution and a mobile solution are being implemented. The fixed solution uses leased circuits and a shared channel to link designated dispatch consoles and agencies together for interoperability. The mobile component uses a package designed to extend interoperability beyond current coverage areas by applying a modular interface system that can be mounted on a mobile platform.

Phase II Interoperability Assistance. The PSWN Program recently began assistance efforts in six other states (MS, TN, WV, AZ, WY, ID). The assistance in these states will range in focus and duration, and will include planning, statewide strategy development, funding analysis, and technical assistance. Since it is the focus of Phase II, interoperability assistance represents the future direction of the PSWN Program. To facilitate the increased focus, a process has been developed and adopted to identify immediate opportunities to deliver assistance to states that need it most. This allows the program to gain leverage from its resources while delivering effective assistance where and when it is needed.

The State of Maryland is Evaluating a Long-term Solution for Public Safety Wireless Communications

During the recent terrorism events in New York and Washington D.C., one of the mechanisms that appeared to have functioned well was the communications systems of the public safety agencies affected. However, Maryland officials have asked themselves whether

their systems would have worked as well if the events had taken place in Maryland. The State of Maryland has been working for the last several years to develop a new statewide communications system. The effort began officially when the 1999 joint chairman's report created an executive oversight committee for 800 MHz wireless systems to try to avoid losing some forty-eight 800 MHz channels for lack of use.

Lieutenant Governor Kathleen Kennedy Townsend created a task force on public safety technology during the 1999 legislative session. The purpose of the task force is to bring cutting-edge law enforcement and corrections technologies to state and local criminal and juvenile justice agencies, to assist in the development of a system implementation plan, and to provide oversight during the implementation of the 800 MHz statewide wireless communications system.

When only 48 of the original 96 frequencies (800 MHz) sought were awarded to the state, officials knew they did not have enough frequencies for a statewide system, so they focused on building infrastructure for future use, on the assumption that additional spectrum would become available in the 700 MHz band once television stations vacated those frequencies.

Part of this statewide infrastructure effort focuses on partnering with local and regional governments and consolidating resources while building out needed infrastructure to leverage resources to realize cost savings statewide. This approach also allows the state to build out the infrastructure quicker than would otherwise be possible because annual budgetary allocations go farther. To fund the infrastructure project, the state legislature created a dedicated wireless technology infrastructure funding mechanism and has provided funding each year since.

The statewide task force created a "Smart Growth/One Maryland Plan" for a future statewide radio system to ensure that it is operationally, fiscally, and tactically feasible.

In FY2000 two major strategic initiatives were started:

1. A 10-phase implementation approach to the build out of statewide infrastructure

2. An innovative partnership theme to work with local and regional governments.

The 10-phase infrastructure implementation plan calls for installation of new infrastructure equipment (usually towers) in specific geographical regions each year. The project is currently in year three and proceeding as scheduled. The last two phases (9 and 10) consist of the implementation of new base station and repeater equipment at all sites within the state (forecasted to be designed around the 700 MHz band), thereby effectively completing a new statewide system infrastructure effort.

The state has been working to formalize the partnerships between itself and the counties within the state. Four memorandums of understanding (MOU) are currently in place, and 14 more are under negotiation. The state has also been working in partnership with adjoining states in an effort to create interoperability across state boundaries through both design and resource consolidation. Maryland currently has a partnership with West Virginia to use existing towers and is also exploring similar co-tower partnerships in Pennsylvania.

The progress made thus far has been significant. To date, 15 towers have been constructed, 22 equipment shelters have been built, and 40 microwave links established. In addition, several pilot projects are under way to further test and explore interoperability methods throughout the state. St. Mary's County has been chosen as the site for interoperability trials planned for fall 2001, and they will be based on voice band integration at the radio consoles. The MSP is conducting a mobile data pilot focused on allowing troopers from anywhere in the state to communicate directly with one another as needed, which they cannot do now.

The Maryland State Highway Administration is conducting a mobile data pilot for real-time highway road condition monitoring and updating as the roads are cleared, etc. They are experimenting with voice-activated and touch-screen reporting functions. In this pilot, each person taking part has an assigned vehicle and assigned mobile computer terminal in his/her vehicle. After training the software to recognize the user's specific voice, the user can then feed the software with simple voice commands as the user observes road conditions. Users make these observations as they drive state highways, and the observations are relayed directly to main host computers at the highway operations center. The messages are relayed to a central monitoring facility via cellular digital packet data (CDPD) technology, and in turn, relayed to appropriate road crews for action.

The State of Maryland has applied for the state-assigned section of spectrum currently available in the 700 MHz band. State representatives are examining ways to work with the broadcasters currently occupying the affected frequencies and hope to migrate them to digital television soon.

At the conclusion of this presentation the following question was asked:

Question: You have a mobile-data working group; does that group also serve as a mobile radio group or do you have another group that does that?

Answer: We have an infrastructure group and everyone is invited to participate in that. No current "radio group" exists across all counties. Right now the infrastructure group is acting in that capacity for the state.

2.2 Fostering Collaboration

The State of Maryland has several exciting communications efforts under way. During the symposium, representatives of state public safety agencies discussed a number of these efforts.

Maryland's Interoperability Operational Challenges Are Being Addressed Though Diverse Projects

The voice radio communications network used by the MSP has evolved over the past 60 years. It consists of several subsystems, each meeting the specific needs of specialized groups within the department. Most radio communications within the MSP are conducted using a low-band radio system operating in the 39 MHz frequency band, with interoperability between many allied agencies provided on MSP "Channel 1." The Executive Protection Unit uses a UHF

repeater system with base stations located in various parts of the state. The National Law Enforcement Emergency Channel (155.475 MHz) is available at every MSP barrack and is installed in each MSP portable radio. With some adjustments, the MSP voice radio communications network has developed into a system able to support the department's communication needs until it is replaced by the next generation communications system.

The MSP low-band radio system has been designed so that a single point of failure has little effect on the total system or safety of MSP personnel. Essentially the system is composed of 23 countywide radio systems normally operating independently of each other. Each MSP barrack is equipped with the channels of its adjacent barracks to provide backup radio coverage. A summary of major components used in the department's low band communications system is listed in Table 1.

Table 1
Summary of Low-Band Components

DESCRIPTION	QTY
Mobile Low-Band Radios	2,162
Vehicular Repeaters	1,188
Portable Radios	1,750
Fixed Equipment Sites	63
Base Stations	150
Dispatch Consoles	23
Frequencies (Low Band)	27
Channels (Low Band)	30

Most Field Operations Bureau vehicles use vehicular repeaters connected to the low-band radios as a method to provide portable radio operation. A vehicular repeater is a device that allows a trooper to control the vehicle's mobile radio using a portable handheld radio. Using the portable radio, a trooper can ideally operate within about a one-mile radius of the vehicle and still have low-band radio communications.

The radio system design philosophy used by the Electronic Systems Division is that a trooper must always have access to a voice radio channel. Such a basic level of performance is the foundation to which other functions are added. This voice channel must never be compromised and must always be available for use because it is the trooper's lifeline or safety net. Any mobile or personal type of data communication system implemented will be used to augment assets available to troopers in the performance of their duties, but not at the expense of a voice radio channel.

The MSP is involved in a number of interoperability projects. First are the numerous arrangements in place to achieve day-to-day interoperability. This is done in a variety of ways, depending on the communications system of the local or regional agency and the frequency band

in which they operate. In several counties, interoperability is achieved through the exchange of radios. In these cases, in addition to their MSP radios, the troopers are also issued a second portable radio in the frequency band of the county in which they work. These are usually 150 MHz, 450 MHz, 490 MHz, or 800 MHz radios. These portables are operable only in the assigned county. Several counties have pending 800 MHz upgrades, and those changes will be incorporated into the trooper vehicles assigned to the affected counties. This will allow car-to car interoperability through a mounted 800 MHz radio in the trooper's vehicle. Finally, several counties have dispatch-to-dispatch interfaces, which allow interoperability through manually activated patches between the dispatch centers.

The MSP is part of a conventional 800 MHz dispatch-to-dispatch interoperability system for the Washington, D C, metropolitan area known as Police Mutual Aid Radio System (PMARS). Additionally, the Baltimore area has a separate but similar system operating on 450 MHz. These two systems maintain contact with a substantial number of federal, county, and local law enforcement agencies and are used in times of emergency or large-scale mutual aid situation in the region.

Additionally, the MSP has a mobile command bus capable of responding statewide and providing on-scene communications interoperability with most law enforcement, fire, and emergency medical services (EMS) providers. This is done through a programmable aviation radio that can be programmed to interface with anything from low band to 512 MHz. The MSP also has a number of small base stations that are preprogrammed with major public safety agency frequencies within Maryland, including limited 800 MHz capabilities.

The newest addition to the "Command One" bus is a transportable gateway audio switch known as an ACU-1000, manufactured by JPS Communications, Inc. This device can link up to 10 radios on different frequencies at the audio level. This transportable radio interconnect system provides radio interoperability during missions requiring communications between diverse organizations using different radios and different frequencies. The system's greatest asset is its ability to provide communications interoperability between high frequency, VHF low-band, VHF high band, UHF, 800 MHz, 900 MHz, trunked talk-groups, and encrypted networks.

The MSP has an additional ACU-1000 that will be used, in the future, to set up in a fixed location to provide regional interoperability. The Alexandria Police Department in Alexandria, Virginia, is presently operating an ACU-1000 as a National Institute of Justice (NIJ) Advanced Generation of Interoperability for Law Enforcement test project (AGILE). The MSP has gained very valuable insights from the Alexandria Police Department in the operation of its switch, and will use those insights while setting up the second unit. Long-term plans are being made to tie these two switches together for increased interoperability in the Washington, D C, Annapolis, and Baltimore areas.

Interoperability in Maryland is alive and well. Opportunities to work with the PSWN Program on present and future projects, as well as continued planning for a statewide communications system make this a time when communications interoperability efforts will move with great speed.

Harford County is a Model for Wireless—Interoperability

This presentation focused on an effort underway in Harford County, Maryland, to consolidate the information and communications systems of law enforcement agencies within that county to realize increased interoperability and efficiency.

The first and most important step in interoperability is to create partnerships at the local level and then move together as a united group. Officials in Harford County immediately recognized the merits and cost benefits of getting involved with the statewide system development instead of replacing and maintaining their own failing systems. The effort began by bringing together a group of law enforcement agencies throughout the county to start talking about consolidation and partnerships. The agencies involved included the Aberdeen Police Department, Bel Air Police Department, Harford County Division of Emergency Operations, Harford County Sheriff's Office, Havre de Grace Police Department, and the MSP. Of course, each agency brought with them their own needs and agendas.

To combat the competitive inclination that naturally arises during these types of efforts, a "study group" philosophy was adopted as the operating model for the working group so that the members could move forward as a group while examining potential partnership scenarios. In order to operate under this model, they agreed on several benchmarks:

- Define citizen safety and service as paramount
- Enhance the safety of personnel
- Work cohesively to solve problems
- Take advantage of unique opportunities
- Be innovative
- Use vision
- Use cutting-edge technologies
- Establish high standards of service
- Be fiscally responsible.

Previous interoperability efforts within the county had included cross-programming of frequencies and radio sharing. By moving forward with a "standard" 800 MHz mentality and assuming that building a new radio system was arbitrarily the solution, the group would have been introducing yet another interoperability obstacle just by virtue of bringing another frequency band into the mix. The group wanted to be aware of that and be smart about moving forward.

The group began by examining lessons learned from significant incidents nationwide involving public safety communications. These events included:

- Columbine High School incident

- Hurricane Hugo

- Frank Green incident (toll facility officer shot and killed on a bridge between Cecil County and Harford County)

- Chase Amtrak derailment.

The group then examined how Harford County's situation was unique and how that would steer their efforts, whatever they might be. Their observations included:

- Two major railroads intersect in the county

- Largest river east of the Mississippi runs through the county
  - Hydroelectric facility dam
  - Nuclear facility

- US Army facility (Aberdeen) in the county
  - Working to neutralize chemical stockpile

- Major interstate highway system

- County is the center of east coast megalopolis.

The Harford County group remained aware that large-scale change in the government sector is usually spurred by large-scale disaster incidents. The group wanted to keep people focused on the day-in and day-out problems that public safety operations experience as they relate to communications—vehicle chases, multi-agency incidents, mutual aid requests, etc. The members felt that they would make better decisions operating in that context and also felt that they would remain more sensitive to the needs of the other partner agencies.

The group also assessed the current state of cross-agency communications and interoperability and made several observations. The Harford County Sheriff's Office and County Fire/EMS operate in different frequency bands than the MSP and the municipal police departments. The municipal police departments did have radios that were capable of communicating with the Harford County Sheriff's Office and County Fire/EMS. The MSP personnel assigned to Harford County were issued second radios capable of communicating with the Harford County Sheriff's Office, but not the municipal police departments.

Once a current state of interoperability had been assessed, the group examined the reasons why the members should explore and institute change in their communications systems. They found that the current Harford County Sheriff's Office and Fire/ EMS Radio System was approaching the end of its life expectancy. This meant that parts and service were becoming more difficult or impossible to obtain and were becoming more and more expensive. The county system was also reaching its maximum capacity at a time when the county was expecting tremendous growth. Technologically, the 460 MHz system does not afford Federal Communications Commission (FCC) protection from interference and does not allow for use of many state-of-the-art radio technologies such as trunking, data communications, secure voice, and maximum use of channels.

The group realized that to sell the concept to the decision makers within the agencies in Harford County, the group would have to emphasize citizen safety and service and the advantages of cutting-edge technologies.

Under the system consolidation model, community safety will be enhanced through—

- Large-scale radio broadcasts to all county agencies
- Crimes in progress and officer in trouble dispatches
- Improved coordination of call dispatch to provide best resource utilization
- Improved task force operations
- Utilization of common call-taking and dispatch procedures and policy.

The anticipated advantages of cutting-edge technologies to the agencies involved include—

- NCIC 2000
- Photos of wanted people, stolen property
- Access to multiple state databases
- Driver photos
- Automated field reporting
- Real time criminal incident and offender information
- Timely and accurate access to data for field personnel.

The working group assessed the situation, options available, and potential advantages, and then made a set of recommendations to the executives of the involved agencies. The five recommendations were—

1. Development and use of a common wireless voice communications system

2. Development and use of a common wireless data communications system

3. Procurement and use of a common computer-aided dispatch and records management system

4. Conversion to use of a common call-taking center

5. Conversion to use of a common dispatch center.

Communications barriers seem to be the final major barriers to a totally coordinated law enforcement and public safety response. Each solitary or stand-alone communications or information technology system represents yet another "organizational wall" that has to be torn down to create maximum effectiveness among the involved agencies. As Maryland public safety moves forward with its missions, it must ask itself whether it is prepared for terrorism incidents like those recently experienced. Could the people that would have responded to such an incident in Maryland's jurisdictions been able to talk to each other? Would they have been able to relay crucial data to other agencies in a timely manner? These questions must be answered honestly and the resulting complications to response overcome.

Wireless Data is Critical in Achieving Interoperability Improvement for Public Safety and Transportation

The Capital Wireless Integrated Network (CapWIN) is unique in the sense that it combines transportation agency needs with those of public safety agencies. It focuses on data communications primarily because of the PSWN Program's focus on voice communications. The project is sponsored by the NIJ, the PSWN Program, the University of Maryland, the Maryland State Highway Administration, the Virginia Department of Transportation, and the U.S. Department of Transportation.

The CapWIN initiative has taken notice of the outdated methods being used within public safety agencies to relay information to one another during critical incidents and multi-agency responses. The region cannot rely on the outdated method of unit-to-dispatcher-to-landline-to-dispatcher-to-unit model for the timely and accurate relay of vital information. CapWIN proposes a partnership between public safety and transportation that would bridge the information gap by establishing a direct mobile data bridge. CapWIN plans to build and install a central data switch that would communicate with all existing local, state, and federal databases and allow them to interact with each other.

Access to databases can be controlled via network access security protocols (e.g., fire agencies would not have access to FBI database information, etc.). CapWIN is also exploring non-traditional partnerships that would allow all involved agencies access to other databases from the Center for Missing and Exploited Children and a national chemical manufacturers' database. This access to real information as needed would improve the safety of personnel using the system and improve the quality of service to the public.

CapWIN has issued a Request for Proposals (RFP) to solicit bids from vendors to construct the message switch, and install and configure the switch system. The vendor community seems to be very excited about the potential for future development in interconnected mobile data systems and has replied to the RFP in earnest.

The benefits of the approach CapWIN intends to take include—

- Increased safety for transportation and public safety personnel and citizens
- Improved coordinated response to multijurisdictional situations
- Cost savings through partnerships and sharing systems
- Better information to make critical decisions.

The project goals of CapWIN are to—

- Identify alternatives for development of a public safety/transportation information network

- Enable authorized users to readily access and use information (data) regardless of whether it is resident in national, state, or local databases and to communicate directly with each other via the same data network.

In order to proceed, the CapWIN project assembled several different stakeholder groups to gain involvement and buy-in for the project. These groups included an executive group, a technical group, a steering group, and an operational group. The executive group includes fire chiefs, police chiefs, transportation leaders, elected officials, state officials, federal officials, and Department of Defense officials.

From a technical perspective, the CapWIN project will use standard network relay procedures to facilitate controlled access to the integrated databases. The CapWIN message switch will be accessed through any traditional wireless method of accessing data (e.g., radio frequency, CDPD, commercial cellular). The message gateway will then translate the inquiry into a common interface language and clear the user (security) for access to the requested database(s).

A pilot project has been in progress for some time involving numerous agencies from Maryland and Virginia using the Alexandria Police Department's mobile CDPD message switch. This pilot project is actually allowing Maryland agencies access to Virginia's criminal database through the City of Alexandria switch. This represents an incredible accomplishment made possible through a tremendous amount of partnering and the negotiation of several MOUs. It is important to note that this particular pilot project focuses more on the operational proof of concept than the technical concept.

The RFP that CapWIN issued outlines two specific tasks to take place during the system build out. Task one provides interagency wireless data communications, including unit-to-unit messaging, for agencies without current service in the affected area, and would put approximately 10,000 users on the switch when completed. This will provide connectivity to criminal justice databases in Maryland, Virginia, and the District of Columbia.

Task two provides planning and design for interfaces to transportation databases, including the State of Maryland's Highway and Road Center, the State of Virginia's Smart Travel Center, and the National Hazardous Materials Database.

The biggest challenge for CapWIN, or any other interoperability project is for all participants to come together and work with one another across jurisdictional boundaries, state lines, and levels of government. All participants must share all available information in order to successfully carry out our missions.

2.3 Interoperability as a Mission-Critical Function

The need to communicate with each other regardless of agency type or jurisdictional boundary is not new to the members of the public safety community. Several current efforts underway within the State of Maryland focus on improving interoperability and heightening awareness about its critical nature. During the symposium, representatives from Maryland, Virginia, and the PSWN Program described some of these efforts.

The Washington, DC, Pilot Project Serves as a Test Bed for Metropolitan and Multi-State Interoperability

The Washington, DC, pilot project is one of the many pilot projects currently sponsored by the PSWN Program. The Washington, DC, area offers unique metropolitan and multi-state challenges, and thus is a valuable place to test innovative interoperability solutions. The Washington, DC, effort actually began several years ago with a comprehensive case study of the communications systems in use in the region and the level of interoperability that existed. Since the case study was completed, several of the agencies in the area have migrated to 800 MHz radio systems. This has helped create some new interoperability opportunities, while at the same time, eliminating some of the older interoperability interfaces that existed under older systems.

The system segmentation for the Washington, DC, pilot is balanced between technology and spectrum. The original case study recommended establishment of an Integrated Program Team (IPT), placement of tri-band repeaters in two areas bordering the District of Columbia, and the funding of a pilot test by the PSWN Program.

The PSWN Program established the IPT to help guide and drive the project to a successful completion. The IPT includes public safety and regulatory agencies from Virginia, Maryland, and the District of Columbia, representing local, county, state, and federal agencies. The IPT meets regularly to discuss the project needs and progress, and continues to work together toward a common goal. In addition, the PSWN Program is also working with the Washington Metropolitan Council of Governments (WMCOG) to improve interoperability to improve existing interoperability methods.

The objective of the Washington, DC, pilot is to improve interoperable communications during multiple agency response missions in high-incidence areas within the metropolitan area and across multiple jurisdictional boundaries while allowing for certain considerations:

- Allows first responders and incident command system to be online, full time
- Permits direct monitoring and awareness of activities by dispatchers
- Is accessible to all area local, state, and federal public safety agencies
- Uses National Public Safety and Advisory Committee (NPSPAC) 800 MHz interoperability frequencies
- Uses multiband repeaters so non-800 MHz users can be added via crossband patches
- Offers a scalable solution that provides a scalable response to metropolitan incidents and that is expandable in the future.

During its work, the IPT discovered two major and different interoperability requirements for the geographic region affected—wide area interoperability and localized, high-incident area interoperability.

Wide area interoperability has historically been handled by two regional mutual aid radio systems. They are the Fire Mutual Aid Radio System and the PMARS. The recent move by many agencies to 800 MHz radio systems was also done recently enough that interoperability was stressed during the planning phases of those independent systems, and thus has brought about a general increase in the level of interoperability in the region on a wide area basis.

Localized, high-incident area interoperability is usually implemented on an as needed basis as a response to some type of critical incident. Historically interoperability among various participant agencies has been accomplished through the establishment of joint command posts and thus relies on the outdated human relay method of exchanging crucial information.

The IPT formed a Wide Area Communications Working Group that recommended a wide area communications concept that included local, state, and federal Washington, DC, area representation, a centralized audio switch interconnection between all or participating jurisdictions, and a system that could be configured to be regionalized, or metro-wide. The IPT has also recommended that the PSWN Program provide assistance to the COG to review and help improve existing wide area communications plans.

A localized, high-incident area is a localized area that has historically had a higher rate of major incidents requiring multiple jurisdictions and agencies to respond. Examples include a gunpowder spill on I-95 South and I-495 and major traffic accident locations such as the American Legion Bridge, the Woodrow Wilson Bridge, the Arlington Memorial Bridge, the interchange of I-95 North and I-495, and the I-270 Split.

Working together, the IPT identified a technology solution to provide communications interoperability at high-incident sites. The IPT is pursuing an interoperability solution that meets its considerations and objectives, including providing—

- Multiband, crossband repeaters for full-time, online crossband communications links to first responders
- Voice communications interoperability at six major high-incident locations or traffic choke points
- Crossband support that seamlessly transitions from first responder to incident command and control operations for a major incident.

The Washington, DC, pilot project is making progress in addressing the metropolitan area's interoperability shortfalls. To date, the IPT has identified six high-incident sites and has identified radio site locations at four of them. The IPT is still looking for suitable equipment locations for the other two locations (Mixing Bowl I-495/I-95 interchange and I-270). The IPT has surveyed the four known sites and is developing a bill of materials for the required equipment. Equipment will be ordered as soon as the equipment lists are complete and certain other organizational issues are resolved.

Despite progress, there are still issues for the IPT to resolve in order for the project to move forward. These issues include the identification of frequencies for use in the piloted

system (still need to identify UHF and VHF frequencies), the method of interconnection for the cross-band repeaters (hard wire versus manual patch), the long-term ownership and maintenance plan for the system once it is completed and operational, and the policies and operating procedures for the system itself.

This and other PSWN Program sponsored pilot projects have shown that the technology exists to formulate almost any technical solution we need to create interoperability. The biggest obstacles to these technical solutions are funding the solutions and working though jurisdictional issues, operational procedures, frequency coordination, and assignment of responsibility issues in order to move the effort forward in an effective manner.

Interoperability is Possible Using Commercial Off-The-Shelf Hardware

As part of the State of Maryland's comprehensive statewide infrastructure project, some monies have been allocated for pilot or "proof of concept" projects focused on testing interoperability solutions in anticipation of the installation of a new statewide radio system. This project uses commercial off-the-shelf hardware to try a different approach to interoperability. The project will provide radio-to-radio interoperability for day-to-day and mutual-aid interoperability. It will provide the interface for two different radios, regardless of their frequency band. The project participants want to bring multiple radio frequency bands together as needed using existing infrastructure while trying to capitalize on current State of Maryland infrastructure build-out efforts. Finally, the project participants want the end solution to be invisible to the radio user.

This project is part of an innovative partnership between St. Mary's County and the State of Maryland. The county is supplying some mutual-aid radios, trunking interface hardware, and all tower and antenna labor. The state is supplying some mutual-aid radios, antennas, and some installation labor. This partnership was created through pre-existing relationships within the existing communications divisions of the involved agencies.

On the technical side, the project calls for the state's digital microwave infrastructure to be intertwined with the county microwave system to carry signals where needed. This system will relay to all four radio tower sites within St. Mary's County and use a voting selector to choose the best signal for relay. This project will allow both conventional and trunked radio systems to communicate with each other. A conventional network interface is used to translate from conventional "radio-ese" to M/A Com trunked "radio-ese" or the reverse. Initial control of the patch, for the purposes of the pilot project, will be at the dispatch console so that the dispatcher can control channel interfacing directly on an as needed basis. This can occur to either connect one conventional channel with another conventional channel or into any talk group or talk groups in the M/A Com trunked system. This network interface system, in essence, translates all non-proprietary transmissions into a uniform conventional mode that can then be relayed to the radios on that system as a standard transmission.

The initial assessment of multiple site relay coverage shows significant coverage for countywide interoperability under the proposed system modification. The state purchased the required equipment through an existing contract with M/A Com and was compatible with the existing countywide trunked radio system (installed by M/A Com previously). The hardwire

includes M/A Com Master III fixed equipment, wide bandwidth VHF, UHF, and 800 MHz antennas, receiver multicouplers and transmitter combiners, vote selector for each mutual-aid channel being used, and a conventional network interface per mutual-aid channel being used.

Complications with the solution thus far have revolved around the issue of relay timing sequences and the difference in timing patterns between simplex transmit/receive systems and repeater-based systems. These issues are being resolved. The next technical challenge is to establish interoperability between St. Mary's County and neighboring Calvert County. Calvert County is using a Motorola system that is incompatible with St. Mary's M/A Com system. The solution being explored involves using microwave interconnections in place of the current cross-radio hardwire links. So far, each county has purchased a radio for the other's system and wired them into their respective systems. When one of these radios is used to communicate with the other's system, the radio's transmission is registered through the conventional network interface as a conventional radio even though it may be a transmission originated in a trunked environment.

The project has made great progress to date. The entire system is expected to be operational in late 2001. So far, three towers have been completely fitted and wired with the necessary interface equipment, and the fourth tower is in progress. All of the necessary hardware is either in hand or in shipment. The remaining work includes determining the exact Calvert County interface, installing the control station radio link, and establishing direct system to system interfacing.

In summary, this pilot project demonstrates the feasibility of using available resources by using an audio switch as the system controller, using existing microwave sites to link the system together, leveraging a countywide coverage footprint to achieve wide area interoperability, and using pre-existing (and under- used) national mutual-aid channels for interoperability. The project has also tried to set an example of simplicity in its approach by using only off-the-shelf hardware and mature, simple communications techniques, and by being designed to be simple to operate.

States are Considering Developing "Super Regions" to Plan for Wide Area Interoperability

This panel was composed of representatives from the State of Maryland (Region 20) and the State of Virginia (Region 42) 700 MHz Regional Planning Committees (RPC). Each of the panel members gave a brief perspective of the 700 MHz planning process and offered the participants the opportunity to ask questions.

Mr. Alan Kealey provided a brief history on the availability of the 700 MHz spectrum. He explained the mandated television station migration to digital television (DTV) and a breakdown of the spectrum available to public safety agencies within the 700 MHz frequency band. The current FCC migration mandate covers the 746–806 MHz frequency spread. The available spectrum has been allocated as follows:

- FCC has made 24 MHz available to public safety.
  - The states can use 2.4 MHz however and wherever they want (do not have to assign to fixed sights) but must coordinate with adjoining states.
  - The states can claim 2.6 MHz specifically for interoperability use.

- FCC has reserved 6 MHz as a guard band.

- FCC will auction 30 MHz to commercial carriers.

The current deadline for station migration is December 31, 2006, although most experts think this date is unrealistic. The mandate for the broadcast stations is based on the percentage of households in each affected area that are capable of receiving DTV signals by the 2006 deadline.

The panel members provided information to the attendees on the process for establishing a 700 MHz RPC under the federal guidelines issued by the FCC. Parts of the requirements include the posting of a public notice for at least 60 days prior to the first meeting. The initial meeting convener can be appointed by the chairman of a previously standing 821 MHz committee or can be selected by a state telecommunications manager within the specific region. At the initial meeting, the RPC attendees can vote to create a committee immediately, if they choose, and then elect board members and immediately begin functioning as a standing committee.

Once established, each RPC has three years to have an approved plan in place regarding the use of the 700 MHz spectrum. To help with the planning process, the FCC created the National Coordination Committee to help the independent planning committees through direct guidance and affording them access to outside resources. The resources include a one-time planning grant of $2,500 that is available to every RPC to help offset the initial meeting costs.

The panel gave a historical perspective on the formation of the RPCs in both Region 20 and Region 42. This included the work that is occurring jointly between the two regions, exploring all possible ways the two groups can work together to create the first "super region" in the country. Both RPCs extended invitations to the attendees to become involved with the respective RPC effort. More information about the RPC and the 700 MHz planning process can be found at www.npspc.org.

At the conclusion of this presentation the following question was asked to Dave Warner:

Question: Virginia public safety agencies seem to be building out 800 MHz systems even today, despite the effort by the state to build out a statewide VHF system—is there any plan to tie in the 800 MHz cities to the system once it is done?

Answer: The state is investigating that issue and exploring ways to overcome that obstacle.

2.4 Successful Models

This section was originally intended to include a presentation by Captain Tom Miller from the Michigan State Police on the process the State of Michigan went through to make their statewide radio system a reality. Captain Miller was unable to attend the event, so a presentation on system security best practices was offered instead. In light of recent events within the United States, security will be a heightened concern for the foreseeable future. It is often overlooked however when planning a system or budgeting for the continued operations and maintenance of a system.

Security Concerns are of Increasing Importance for Public Safety Radio Systems

Now more than ever, the security of our Nation's critical infrastructures is of paramount importance. The domestic public safety response is a critical infrastructure as is its communications systems. Public safety must act with prudence when planning for or operating its systems. There have been numerous recent examples of public safety radio systems being compromised either physically or electronically, which demonstrate the need for increasing system security.

Earlier this year in Omaha, Nebraska, a "radio hacker" broadcast several minutes of the Van Halen song "Jump" while police officers there were trying to negotiate with a suicidal person threatening to jump from a bridge. Also earlier this year, police in Minnesota arrested a man who had been transmitting unauthorized and misleading information over police frequencies for years via a homemade transmitter.

The technology to intercept and interfere with and/or transmit on public safety frequencies is generally available to members of the public. This very notion should cause alarm, yet it seems to have been accepted apathetically by the general public safety community. In addition, computer-based hackers pose a threat to interconnected systems when they are interdependent as relay links or are based on Internet protocol (IP) or other computer protocols. The fact that public safety radio systems are becoming increasingly dependent on networked technology to function with each other exposes them to increased vulnerabilities and should cause some uneasiness about current security practices.

Current security threats to public safety radio systems include—

- Interception
- Frequency jamming
- Intrusion and impersonation
- Natural disasters
- Physical attack in infrastructure sites.

The challenges and threats to any radio system fall into three categories.

1. **Confidentiality—**The protection that ensures that information is not made available or disclosed to unauthorized individuals, entities, or processes

2. **Integrity**—The protection that ensures that data have not been altered, repeated, or destroyed in an unauthorized manner, either accidentally or maliciously

3. **Availability**—The accessibility and usability of service upon demand by an authorized entity.

In addition, the information that needs to be protected is more varied than originally or commonly perceived and goes beyond traditional law enforcement encryption needs. Many times, fire department units relay information about security accesses to structures or gated developments. Ambulances frequently relay sensitive medical information about their patients while en route to the hospital. The good news is that both short- and long-term solutions exist to address each of the challenge or threat categories.

Immediate steps can be taken to bolster public safety systems transmission security. They include understanding that the "private call" feature on the radio does not offer voice security, providing encryption capability for all equipment on the system, using "end-to-end" encryption to lower the probability of compromising intercepted communications, ensuring that users receive proper training in the importance of encryption use, ensuring that key management guidelines are developed such that all keys are handled in a secure and controlled manner, and storing encryption key loaders in a secure environment.

Immediate steps can also be taken to bolster the integrity of data moving through public safety radio systems. Just a few include providing security requirements and guidelines to system and database administrators, configuring security mechanisms of system software properly, and implementing stringent password constraints to restrict access to system resources. Additional measures can include limiting access to systems to only a limited number of people, separating functions between system/database administrators and security officers, and conducting regular audits of system and security procedures.

There are also immediate actions that can be taken to bolster availability of system during disaster incidents. Excellent examples of ways to protect your communications system and prepare it for operation after a disaster include controlling access to radio equipment by implementing some form of physical access controls (especially for those sites collocated with other organizations) and using alarm and monitoring systems to detect unusual activities at radio sites. Other example include providing redundant infrastructure to ensure system reliability and availability, backing up system data regularly and storing the backup tapes in a secure environment (off-site storage facility), providing adequate environmental controls to protect system components, and not advertising locations of communications centers and radio sites. .

Long-term solutions to the security needs of a system are all addressed by incorporating them into a complete life-cycle approach to system management. By making security a main

concern while planning out a system and making security a continued priority while budgeting for continued operations and maintenance of that system, managers can anticipate the costs associated with those activities. Many times these costs are the first to be cut from a system budget, in an effort to reduce the overall costs of the system. This is a dangerous path to take and could lead the system and its personnel to a position of danger, not to mention leave a set of public safety personnel without a necessary resource at a time when they may need it the most.

It has been thoroughly demonstrated that the security of our public safety communications infrastructures affects everyone. Radio communications systems must support secure communications (encryption) to protect lives of public safety officers and the lives and property of America's citizens. Physical and system security measures must be provided to help public safety agencies effectively and efficiently carry out their critical operations. Agencies must keep their operating and security policies up to date to protect their systems from newly introduced threats. There must be significant coordination among leaders from all levels of government and public safety officials. As government leaders ensure adequate funding is available to secure existing systems and strive to fund new systems, the public safety agencies can incorporate security measures into their existing systems to the greatest extent possible and take a life-cycle approach to building security into their new systems.

It is also important to note that while all of this is applicable to agencies that own and operate their own radio systems, it is equally applicable to those agencies who lease space on another system, whether it be a public or commercial system. Do you know what that entity's security procedures are? Are you satisfied with their physical security measures or do you know how they protect the integrity of system data? Now is the time to find out and work with that entity to improve security for everybody on the system.