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# Statewide Radio Communication

## Vision of Action

The State of Michigan works diligently to provide all Michigan public safety agencies with access to an interoperable statewide public safety communication system. We strive to provide the ultimate in both interagency and intra-agency interoperability and facilitate cost-effective implementation and utilization of new communication technologies for member agencies.

The Michigan Public Safety Communication System (MPSCS) provides state-of-the-art communications using advanced technology based on nationally recognized standards contained in the Association of Police Communications Officers (APCO) Project 25 specifications. As a leader in standards-based public safety interoperability, it is essential that the MPSCS stays current with new and important lifesaving communication technologies. The ability to share information on demand and in real time, whether it is voice or data, is critical to the first responder.

The function of any public safety communication system is to assure rapid response and cooperation of emergency personnel. The MPSCS achieves this through statewide coverage and advanced technology, while remaining reliable and easy to use. System operation is monitored 24 hours a day to ensure its readiness to assist Michigan's first responders. The MPSCS is the primary communications interoperability solution for Michigan's public safety first responders.

## Background

The MPSCS is a statewide radio communication system that:

- serves more than 1,203 federal, state and local public safety agencies.
- is comprised of 239 tower sites, more than 20 integrated state and local public safety dispatch centers and a network communications center serving more than 50,600 radios.
- provides 97 percent all-weather mobile coverage across Michigan.
- provides enhanced portable coverage within Genesee, Macomb, Monroe, Saginaw and St. Clair counties as well as the city of Detroit.

Starting in the mid-1990s, the state made a significant investment to provide statewide radio communication for first responders. While the MPSCS was originally implemented to serve the Michigan State Police, the Michigan Department of Natural Resources and Environment and the Michigan Department of Transportation also rely on the system. More importantly, more than 1,100 local public safety agencies have joined the MPSCS, accounting for 83 percent of the system's "push-to-talk" radios (PTTs).

Today 75 percent of the radios on the MPSCS belong to local public safety agencies. The MPSCS is robust enough to serve the needs of many more local, state and federal agencies. Local agencies find the MPSCS financially attractive. They benefit by leveraging the state's investment, which also provides the interoperable communications essential to today's first responders. In some cases, smaller agencies need only acquire radios to join the MPSCS, while larger agencies frequently add towers and devices to provide in-building portable coverage within their jurisdiction or to meet other special local needs.

## MPSCS Goals

- Goal 1: Interoperability  
Any MPSCS member can speak with another member with the touch of a button.
- Goal 2: Leading-Edge Technology  
Technology is continuously evolving to better meet the needs of public safety agencies.
- Goal 3: Restricted Funding Source to Address System Operations and Upgrades  
MPSCS enables agencies to pursue interoperability instead of struggling with ongoing funding issues.
- Goal 4: Rebanding the MPSCS to New 800 MHz Spectrum  
This effort eliminates interference by separating the frequencies used by public safety and cellular systems.

# Statewide Radio Communication

## Goal 1: Interoperability

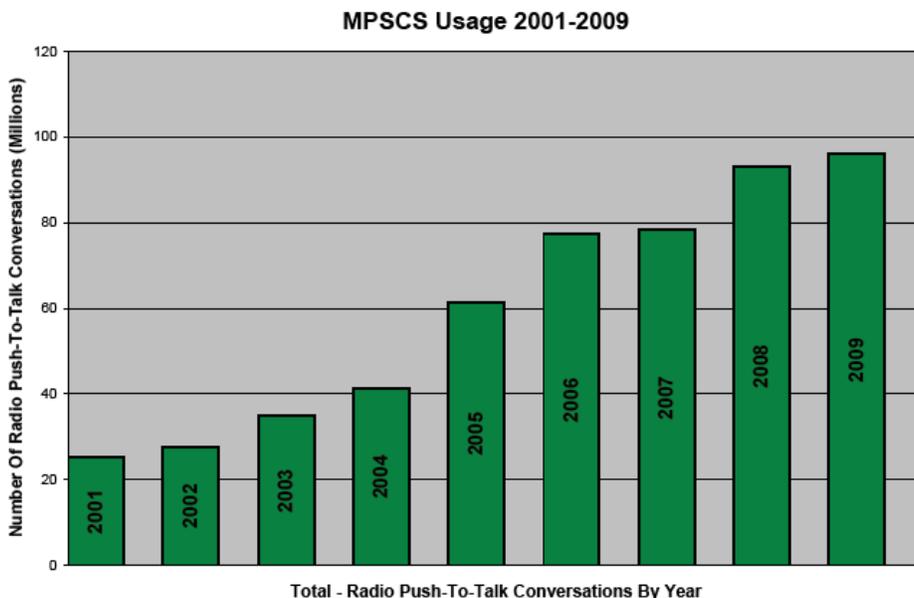
The MPSCS provides local, county and statewide interoperability without implementation of the cumbersome interconnections between radio systems known as patches. Because it is a standards-based shared system, any MPSCS member can speak with another member with the simple touch of a button, a feature that has already proven to be a lifesaving, safety-enhancing tool for Michigan citizens and public safety officials.

The system's ability to expand and adapt to unique requirements permits it to accommodate current and future interoperability needs of Michigan's public safety community. The system's flexibility allows agencies that wish to achieve a specific level of portable radio coverage to add sites or other coverage-enhancing facilities. The system's adaptability allows various approaches to enhanced coverage.

- A. Continue to provide the highest level of interoperability for all first responders in Michigan
- B. Facilitate the addition of several thousand new radios by agencies that received federal grant money
- C. Support initiatives for improving interoperability in Michigan
- D. Continue system enhancements to expand and improve mobile radio coverage statewide
- E. Support 911 dispatch center consolidation initiatives
- F. Work with other counties to facilitate integration of subsystems to the MPSCS
- G. Support other forms of interoperability between the MPSCS and public safety agencies still utilizing radio systems on analog mode or other frequency bands

### Interoperability Targets:

- 2011 - Facilitate the addition of several thousand new radios by agencies that were awarded Public Safety Interoperable Communications (PSIC) grant money beginning in the spring of 2008 with completion of all projects by 2011
- 2012 - Support completion of the MPSCS Urban Area Security Initiatives (UASI) for improving interoperability in southeast Michigan
- 2010-2014 - Support completion of 911 dispatch center consolidation projects for the Michigan State Police and local public safety agencies
- 2010 - Implement the MPSCS IP consoles in the Washtenaw County simulcast subsystem
- Ongoing - Support other forms of interoperability among the MPSCS users and public safety agencies still using radio systems on analog mode or other frequency bands



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## Goal 2: Leading-edge Technology

The MPSCS has been recognized as one of the nation's premier public safety radio communication systems. That recognition is based, in part, on the system's adoption of state-of-the-art technology and its size, both in a covered and the large number of radios on the system.

The MPSCS uses the latest digital-trunked technology. The system is also compliant with the Association of Police Communications Officers (APCO) Project 25 standards. These standards establish a common baseline of equipment specifications allowing various manufacturers to design and supply compatible radio equipment. The standards are continuously evolving to meet the needs of public safety agencies.

Future MPSCS upgrades will include wireless broadband data capabilities, automatic person and vehicle locator capabilities, integration of Computer-Aided Dispatch (CAD) with existing mobile data clients and integration with Records Management Systems (RMS) offering many options for the first responder community. The future opportunities will rely heavily on expanded wireless data capabilities. This will significantly increase options by leveraging the existing shared-services model of the MPSCS. It will allow additional data features, including automated access to centralized databases.

Leading-Edge Technology Objectives:

- A. Upgrade the MPSCS to add wireless broadband data capabilities and integrate more advanced simulcast systems
- B. Implement 700 MHz radio sites to provide access to additional interoperable spectrum
- C. Incorporate lifecycle remediation of aging equipment
- D. Offer the latest proven technologies while maintaining compliance with established, recognized Project 25 standards to ensure the system never becomes technologically obsolete
- E. Incorporate vehicle and person locator technologies
- F. Expand data transmission and sharing capabilities

### Leading-Edge Technology Targets:

- Ongoing - Maintain Project 25 compliance by incorporating new, tested standards such as the Inter Sub-System Interface (ISSI) component and upgrading the MPSCS system software to Version 7.11
- 2010-2013 - Expand data transmission and sharing capabilities utilizing MPSCS-delivered wireless broadband technology
- 2012 - Upgrade the MPSCS to add wireless broadband data capabilities and integrate more advanced simulcast systems
- 2011 - Pilot 700 MHz radio sites to provide access to additional interoperable spectrum
- 2012 - Implement 700MHz voice channels
- 2013 - Implement Automatic Vehicle Locator (AVL) and person locator technology

## Goal 3: Restricted Funding Source to Address System Operations and System Upgrades

The State of Michigan is dedicated to keeping the MPSCS technology current. Given the appropriated general funding in the past decade, the MPSCS has been unable to make timely lifecycle remediation and system upgrades. Success at moving from the general fund to a restricted funding source will provide the MPSCS with the ability to restructure subscriber and other related fees. This will facilitate a shift of focus for the agencies, allowing them to pursue interoperability instead of addressing ongoing funding issues. This type of model, which is used elsewhere in the nation, should be leveraged in Michigan to protect the public safety community from shrinking general fund budgets.

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The system utilizes the Motorola ASTRO 25 Version 6.9 IP voice platform, a stepping-stone for future upgrades and enhancements. The system will adopt new technologies as standards develop and funding is available. For local public safety agencies, constructing a stand-alone system makes the agency responsible for upgrades, a process that can be costly and disruptive. By contrast, upgrades to the MPSCS infrastructure are installed at no charge to members; thus, users are provided the latest technology without the need to secure additional funds.

The MPSCS administrative, technical and engineering staff remains dedicated to maintaining the system at the proven, forward edge of technology.

#### Restricted Funding Source Objectives:

- A. Develop a sound, secure restricted-funding strategy for lifecycle maintenance and future upgrades
- B. Upgrade the MPSCS to Motorola's ASTRO 7.11 software platform
- C. Continue to upgrade infrastructure
- D. Expand the Interoperability Gateway Network to support a strategic technology reserve and enhance system monitoring

#### Restricted Funding Source Targets:

- 2010 - Expand the Interoperability Gateway Network to support both a strategic technology reserve and enhance system monitoring
- 2011 - Upgrade the MPSCS to Motorola's ASTRO 7.11 software platform
- 2011 - Develop and secure a funding strategy for future upgrades and lifecycle maintenance

### Goal 4: Rebanding the MPSCS to New 800 MHz Spectrum

Several years ago, the Federal Communications Commission (FCC) responded to significant interference to public safety communications created by the introduction of cellular architecture systems into the commercial 800 MHz spectrum. After much public debate, the FCC issued an order for public safety agencies on the 800 MHz band, including the MPSCS, to relocate within the band. This relocation separated the frequencies used by public safety and cellular-type systems to eliminate the interference.

This rebanding process includes the retuning of every radio on the MPSCS and its entire 800 MHz infrastructure. Sprint Nextel, whose 800 MHz cellular telephone system is a principle source of the interference, agreed to fund the reconfiguration.

To successfully complete the rebanding and minimize disruption to the working public safety communication system, MPSCS staff developed a strategy for the rebanding implementation. At present, plans are largely complete and awaiting only final resolution of certain international border area agreements.

#### Rebanding Objectives:

- A. Complete the development and facilitate approval of a comprehensive rebanding plan for the MPSCS
- B. Improve ongoing inventory and administrative processes for the MPSCS to accommodate efficient rebanding efforts
- C. Eliminate interference to all public safety radios on the MPSCS through rebanding
- D. Ensure comparable operational characteristics after

#### Rebanding Targets

- 2011 - Complete development and facilitate approval of a comprehensive rebanding plan for the MPSCS
- 2011 - Eliminate interference to all public safety radios on the MPSCS through rebanding
- 2012 - Ensure comparable operational characteristics after completion of the rebanding

# Statewide Radio Communication

process

## MPSCS Planning

Provided below are examples of some short- and long-range plans that we have established. These plans focus on four areas:

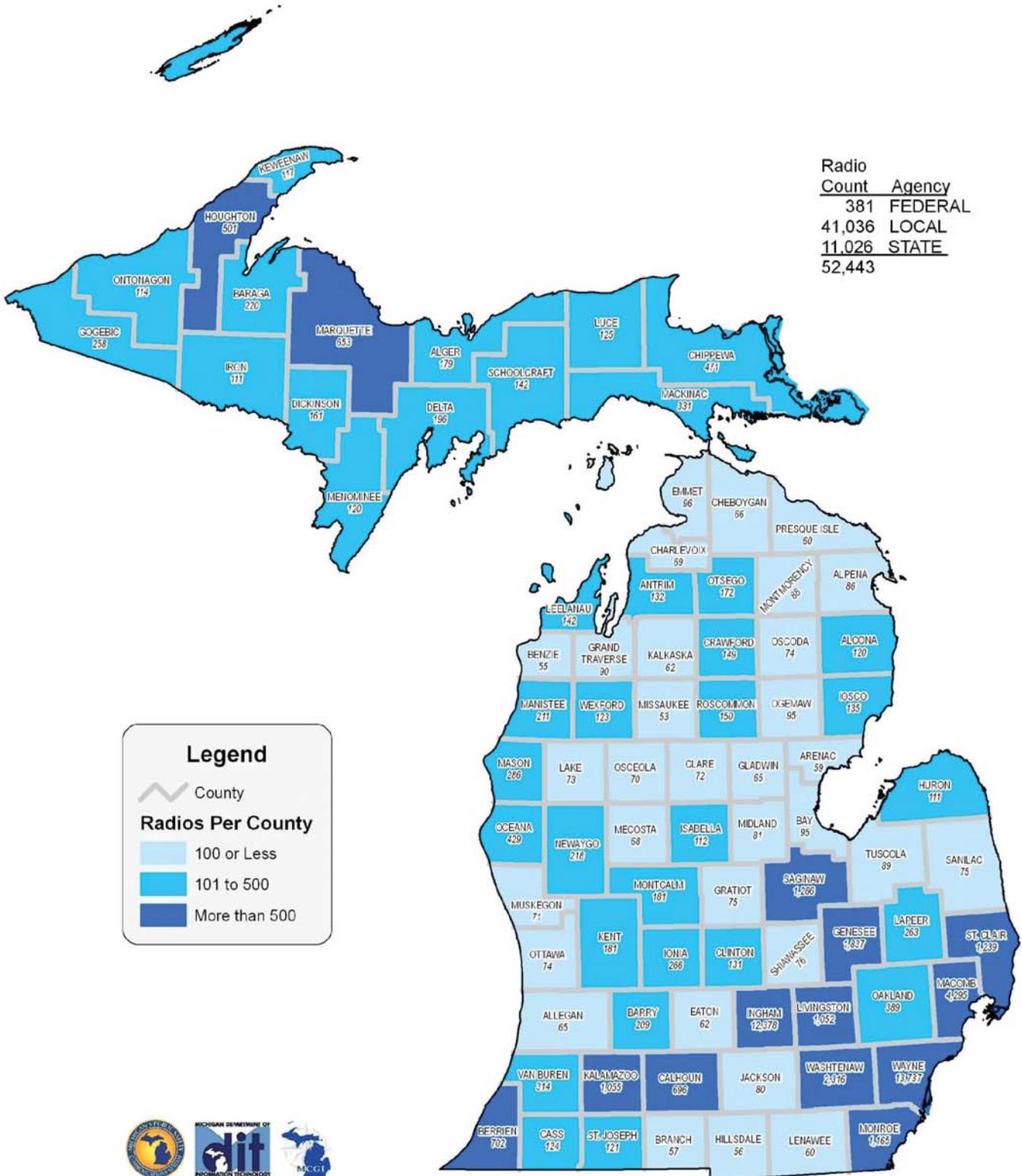
- A. Carrying out and facilitating the distribution and sharing of information
- B. Providing ease of use and accessibility
- C. Ensuring security and protection of information
- D. Promoting the use of central/shared systems

## Short-range Plans

- Add New Members - Identify MPSCS upgrade opportunities and provide additional subscriber IDs that will accommodate added radios leading to the expanded use of MPSCS for public safety interoperable communication needs.
- Complete Upgrades and Plan for Future Improvements - Many types of upgrades are necessary to keep the MPSCS a top-notch system. They include software upgrades, localized equipment changes and other changes necessitated by equipment obsolescence or failure. Equipment has a finite lifecycle. Aging equipment must be replaced to maintain a continued level of performance and obtain new capabilities and features implemented in the later design versions of the equipment. Some essential planned upgrades are:
  - ✓ Dispatching: The system has reached a limit in adding dispatch consoles in southeastern Michigan. A software upgrade will eliminate the need for existing legacy audio switches and create more dispatching capacity.
  - ✓ Monitoring and Alarm: The infrastructure monitoring and alarm function is rapidly becoming outdated, and support is becoming problematic.
  - ✓ System Diagnostics and Performance Metrics: The ability to conduct system diagnostics and performance metrics is limited. Adding software tools for predictive analytics will help the engineering team and Network Communications Center analyze the effects of changes to the system.
  - ✓ Cyber-Security Controls and Encryption: It is critical to add advanced networking technology and security controls and check points to the system. These additional controls will prevent access to the MPSCS and protect criminal justice information that is transmitted in voice and data form. These changes are required by the federal and state criminal justice information systems security policies. Monitor and Build System Capacity
- Monitor and Build System Capacity - As more public safety users join the MPSCS, system capacity must be monitored closely. When additional capacity is needed in certain areas, additional frequencies must be acquired. The MPSCS currently operates in the 800 MHz National Public Safety Planning Advisor Committee (NPSPAC) band, which is quickly becoming full in high population areas. The 700 MHz band will be available for use by public safety in the future. Both 800 MHz and 700 MHz may be used in a single radio by purchasing equipment capable of operating in both. The addition of the 700 MHz band increases system capacity in areas where the 800 MHz band is congested. Future technology improvements also will help address system capacity

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## Michigan Public Safety Communications System Radio Count - 2010 Projections



**Legend**

County

**Radios Per County**

- 100 or Less
- 101 to 500
- More than 500

Produced by  
Center for Geographic Information  
Michigan Department of Information Technology  
<http://www.michigan.gov/cgi>  
02/10/09

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- Provide Interoperability Options for Users and Non-users - Interoperability is a widespread priority in the United States, in large part because of acts of terrorism and natural disasters. It is a primary function of Michigan's communication system. At present, several interoperability options are available and in use with the MPSCS.
  - ✓ Access to FCC-designated mutual aid and tactical channels. These channels use analog modulation and are available to all user radios operating in the 800 MHz NPSPAC band, regardless of home system type.
  - ✓ With the 800 MHz rebanding presently underway, one challenge is maintaining interoperability with Canadian public safety agencies. Under the current system, U.S. and Canadian agencies using 800 MHz frequencies have access to a number of common channels. These common channels may be lost depending on the final border area frequency agreements established between the United States and Canada.
  - ✓ Non-MPSCS users on compatible 800 MHz digital trunking systems may have their radios programmed to operate on selected talk groups on the MPSCS system. Likewise, certain MPSCS users may have their radios programmed to operate on other compatible systems.
  - ✓ Non-MPSCS users using non-Project 25 standard systems or incompatible 800 MHz analog or digital home systems have access to the five common 800MHz mutual aid and tactical channels.
  - ✓ A cache of MPSCS radios is maintained. These radios may be used in situations where other agencies do not use radios compatible with either of the previous options.
  - ✓ Finally, the MPSCS allows patches (interconnection via an appropriate interface circuit) to other radio systems in specific situations. This is not an optimal solution as it creates additional loading impacts on the MPSCS resources and only operates effectively within the coverage area of the other agency's system.
- Dispatch Consolidation - The trend in the state is to consolidate 911 call-taking and dispatch operations into centralized facilities in cities and counties handling multiple agencies. This provides better coordination, improved facilities, reduced system requirements and the potential for staffing reductions and cost savings. The MPSCS members have consolidated dispatch facilities in a number of counties.

The MPSCS dispatch systems currently operate on a platform that is limited by its dated synchronous architecture. Because of the extraordinary growth of the MPSCS, certain areas of the state are near the maximum number of dispatch consoles that can be supported. The MPSCS is addressing these issues through dispatch consolidation and proposed system upgrades. As part of a MPSCS dispatch consolidation, new IP-based equipment will be used. This equipment has greater capacity and is far more efficient, allowing the MPSCS to accommodate its rapid system growth and dispatch needs.

Project 25 standards now include IP-based dispatch consoles as part of the CSSI console sub-system interface standard. This will allow the MPSCS to have greater flexibility in purchasing from multiple vendors, eventually resulting in greater savings through the competitive bid process.

## Long-range Plans

- 700 MHz spectrum availability - The FCC has allocated 24 megahertz of spectrum to public safety in the 700 MHz band. There is an issue preventing MPSCS use of this spectrum at present. The first is the existence of several television stations on the spectrum in the southern portion of the Lower Peninsula. The stations must vacate the spectrum by February 2009.

The other issue is the FCC acceptance of the Michigan 700 MHz band plan. This plan details how the Michigan Regional Frequency Advisory Committee intends to allocate the frequencies in the 700 MHz public safety spectrum. The plan has been submitted to the FCC. Once the plan is accepted, the Regional Planning Committee will be authorized to

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review and approve license applications.

- The 700 MHz spectrum will provide additional narrowband voice channels. It will also allow aggregation of channels in a designated portion of the available 700 MHz spectrum into wideband channels. This portion of the spectrum is the subject of much current debate and could be affected by FCC rules covering the auction of commercial 700 MHz spectrum.

A proposal to create a private carrier-public safety partnership to build a broadband, nationwide system was created by the FCC and incorporated into the recent auction of the 700 MHz spectrum. The network would provide commercial service with public safety users having priority access. However, the spectrum allocated for that partnership did not receive the FCC's required minimum bid and was not sold. The FCC is re-evaluating the rules it created for that partnership and is expected to revise those rules and attempt another auction of the spectrum later this year. The auction of the commercial spectrum was congressionally mandated to begin in January 2008.

- 4.9 GHz – The 4.9 GHz spectrum is useful for short-distance, point-to-point microwave links as it is similar to microwave. It is relatively short range with moderate gain antenna systems and is useful for low-cost point-to-point connections or in creating data “hot spots” similar to the Worldwide Interoperability for Microwave Access (WiMAX) systems used with personal computers.

The relatively low cost of equipment for this purpose makes implementation attractive. However, the use of uncoordinated frequencies in this band may limit its usefulness because of interference from systems in adjacent areas using essentially the same frequencies. Some effort has been made to establish the Michigan Regional Planning Committee as a frequency coordinating body for this spectrum. At this time, however, there is no official authority in place to take on this responsibility.

## New Technologies of the Future

Some new techniques and technologies that may be employed in the MPSCS in the future are:

**Automatic Vehicle Locator (AVL):** The AVL technology will allow public safety personnel and other government users of the MPSCS the ability to monitor and deploy the closest vehicle to an incident scene. This technology will also provide advanced tracking mechanisms for emergency personnel when outside their vehicles, while giving dispatchers the capability to track the first responder. This technology would use the MPSCS and its current coverage capabilities for service delivery.

**Computer Aided Dispatch (CAD):** Computer Aided Dispatch integrates the existing in-vehicle mobile data client with the dispatch center, allowing true end-to-end deployment of resources to any events using the data portion of the MPSCS. This will allow voice and data interactions from the vehicle to the dispatch center and provide the means for future integration technologies such as fishing/hunting license retrieval, geographic information systems (GIS), records management systems (RMS) and mug shot systems delivered to the vehicle or accessible from the vehicle.

**Mesh Technology:** Already used in some limited data-network applications, the wide-area application of mesh technology could reduce the requirements for additional base station sites while providing improved coverage, especially in rural locations. Mesh technology turns each user radio into a data repeater, which passes received data packets on to all other user radios within range. In turn, these radios pass data on to all radios within their range, and so on. Coverage is enhanced because each radio needs only to communicate with another nearby radio instead of a fixed-location station, which may be considerably farther away.

**Software Defined Radio:** Another technology now reaching maturity is the software-defined radio. This is essentially a computing platform married to broadband radio frequency components. The operating characteristics of the resulting radio are determined by the software running in the computing platform. The computing platform is used to generate various frequencies and waveforms to process the received signals. The radio can span significant portions of spectrum and operate in a variety of modes in analog or digital configurations. This flexibility will enable the radio to interface with a wide variety of services and provide a wide range of capabilities.

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Images: There is little doubt that public safety communication systems will soon carry image data. This may be relatively simple, fixed images such as driver's license images at first, but once the gate is opened, advanced high-resolution imaging and real-time video will surely follow. This will place additional bandwidth requirements on public safety systems.