**National Highway Traffic Safety Administration**
**Office of Emergency Medical Services (EMS)**


**Report to Congress:**

# Emergency Communications Centers and the Role of Communications Technologies in Reducing Mortality Rates in the Rural U.S.


Submitted by Maryn Consulting Inc.
Contract DTNH22-14-F-00579
Submitted 12/30/15
Revised 1/15/16

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# List of Frequently Used Abbreviations

| | |
|---|---|
| **ATS** | Alabama Trauma System |
| **ATCC** | Alabama Trauma Communications Center |
| **DHS** | Department of Homeland Security |
| **ECC** | Emergency Communications Center |
| **EMS** | Emergency Medical Services |
| **REMSS** | Regional Emergency Medical Services System |
| **LMRS** | Land Mobile Radio Systems |
| **LTE** | Long Term Evolution (4G) |
| **MIEMSS** | Maryland Institute for Emergency Medical Services Systems |
| **NG911** | Next Generation 911 |
| **NHTSA** | National Highway Traffic Safety Administration |
| **PSAP** | Public Safety Answering Point |
| **VHF** | Very High Frequency radio band |
| **UHF** | Ultra High Frequency radio band |

# Section 1 Executive Summary

This report responds to a Congressional request for the National Highway Traffic Safety Administration (NHTSA) to examine the premise that improved pre-hospital emergency response is vital to reducing mortality on America's highways and interstates, particularly in rural States where deaths per capita are highest. NHTSA is responsible for reducing deaths and injuries resulting from Motor vehicle crashes, and an efficient emergency medical services system is integral to reducing injury and mortality on the Nation's roadway.

S. Rept. 113-182 – Transportation and Housing and Urban Development, and Related Agencies Appropriations Bill, 2015:

"The Committee believes that improved pre-hospital emergency response is vital to reducing mortality on America's highways and interstates, particularly in rural States where deaths per capita are highest. Providing high-quality emergency response, including the deployment of technology platforms that improve communications and speed transmission of data, photo images and real-time video to a remote trauma center, may improve outcomes and save lives. As such, the Committee directs NHTSA to consult with the Department of Homeland Security and the Department of Health and Human Services to provide a report to the House and Senate Committees on Appropriations that identifies models of regional and statewide Emergency Communications Centers (ECCs), the mechanisms by which these models could be integrated into existing emergency medical services and trauma systems, and the potential ability of medical communications centers to use evolving and innovative digital technology to reduce traffic fatalities."

The National Highway Traffic Safety Administration identified long-standing Emergency Communications Centers (ECCs) in Alabama, Maryland, and Mississippi and conducted an in-depth examination of these programs, with the specific intent of understanding the potential impact on mortality rates through the application of communications technologies by these ECCs.

The specific ECC programs examined are:

- Alabama Trauma System/Alabama Trauma Communications Center (ATS/ATCC)
- Maryland Institute for Emergency Medical Systems and Services (MIEMSS)
- University of Mississippi Medical Communications Center (MS-MED-COM)

In addition, as a component of this report, a literature review was conducted to determine what, if any, formal studies or reports reside in the public domain that reinforce the basic premise that the application of communications technologies has a positive impact on patient mortality rates. Multiple peer-reviewed journal articles are listed in Attachment A.

## 1.1 ECC Models

The focus of this report is on Emergency Communication Centers, also called medical communication centers, trauma communication centers, or emergency medical resource centers.

Generally speaking, these are physical locations, staffed 24 hours/day, seven days/week, 365 days/year with certified professionals that assist first responders in the field with the coordination, communication, information, and in some cases determination of where and how injured patients are transported, based on medical emergency, severity of trauma, status and capacity of nearest hospitals, available emergency transport, and incident type.

The three ECCs examined here share similar missions and provide similar value to the areas they serve. However, the use of communications technology beyond radio, the level of public funding, governance structures, and authority levels are different in each state.

## 1.2 Observations and Conclusions

**ECCs are critical components of larger trauma systems**

The Alabama, Maryland, and Mississippi ECCs are each a critical component of the trauma systems deployed in their States, supporting day-to-day trauma triage, as well as mass casualty emergency response, management, and coordination when necessary. Additional similarities include:

- Each initially started as a smaller or regional service, then expanded statewide with statutory authority.
- Each expanded incrementally, as trauma systems expanded.
- Technologies deployed have advanced over time.
- Each, in some fashion, built upon regional, State, and Federal programs over the past 30-40 years that provide cooperative frameworks designed to serve the patient.

**Communications technologies are crucial to the operations of an ECC**

The application of communications technology, both new and old, has and will continue to have an impact on mortality rates in States that have implemented some model of an ECC. A few studies suggest that the deployment of an ECC, operating in support of a formally established trauma system, also furthers the capabilities of a trauma system in reducing mortality rates.

The operation of an ECC is fully dependent upon different types of communications technologies, both old and new. The First Responder Network Authority (FirstNet) and Next Generation 911 will likely impact ECCs and may provide opportunities for ECCs to implement more services and to become more incorporated into larger communication networks and systems.

The Alabama, Maryland, and Mississippi ECCs are each tied to State and local radio systems that also interconnect to first responders, emergency management, and hospital/treatment facilities. It is important for the ECC's to examine how they fit into the larger emergency communications ecosystem, as envisioned by Department of Homeland Security (DHS) Office of Emergency Communications. http://www.dhs.gov/national-emergency-communications-plan

**Public / Private and Public / Public Partnerships are vital**

Public / Private and Public / Public partnerships play key roles in each of the ECCs observed. Communicating and coordinating across multiple entities is a primary focus of an ECC. Partnerships are critical to ensuring this communication and coordination is effective. Partnerships between multiple public and private entities address numerous issues, including

funding, staffing, infrastructure, capital costs, operating costs, regulation, governance, certification, systems processes and procedures, training, and authority.

**Funding and 'keeping up' are major challenges**

Ongoing funding for the purchase, operation, maintenance, and support of communications technology is the major consistent and common challenge facing all three ECCs examined. As technology rapidly advances, the purchase and implementation of new technologies and system-wide updates are costly and logistically challenging.

To address this challenge, Maryland, uses a methodology primarily focused on owning and operating the essential technologies, while Alabama and Mississippi have adopted a methodology of using service-based or contract-based arrangements.

Beyond the immediate communication and coordination of EMS services, it is essential for an ECC to align with the interoperable communications technologies deployed by other responding agencies like 911 and State radio systems. In some cases it is possible to leverage resources to achieve this alignment, which is necessary for successful operations.

# Section 2 Background, Methodology, and Literature Review

This report responds to a Congressional request for the National Highway Traffic Safety Administration (NHTSA) to examine the premise that improved pre-hospital emergency response is vital to reducing mortality on America's highways and interstates, particularly in rural States where deaths per capita are highest.

## 2.1 Background

S. Rept. 113-182 – Transportation and Housing and Urban Development, and Related Agencies Appropriations Bill, 2015:

"Emergency Communication Centers.—The Committee believes that improved pre-hospital emergency response is vital to reducing mortality on America's highways and interstates, particularly in rural States where deaths per capita are highest. Providing high quality emergency response, including the deployment of technology platforms that improve communications and speed transmission of data, photo images and real-time video to a remote trauma center may improve outcomes and save lives. As such, the Committee directs NHTSA to consult with the Department of Homeland Security and the Department of Health and Human Services to provide a report within 180 days of enactment to the House and Senate Committees on Appropriations that identifies models of regional and statewide medical communications centers, the mechanisms by which these models could be integrated into existing emergency medical services and trauma systems, and the potential ability of medical communications centers to use evolving and innovative digital technology to reduce traffic fatalities."

## 2.2 Methodology

The National Highway Traffic Safety Administration identified longstanding Emergency Communications Centers (ECCs) in Alabama, Maryland, and Mississippi and conducted an in-depth examination of these programs, with the specific intent of understanding the potential impact on mortality rates through the application of communications technologies by these ECCs. Additional research was completed to identify relevant published literature regarding ECCs, trauma systems, and communications technologies. The following approach was used to produce this report.

1. Initiation, scope and planning
2. Report outline
3. Literature review
4. Initial information gathering with identified ECCs
5. ECC interviews and site visits
6. Report development

### *2.2.1 ECC Outreach and Communication*

A critical component of the methodology for this report was to identify, engage, and gather information from the identified ECCs (#4 and #5 listed above), at the practitioner level. It was important to develop an on-the-ground and in-the-field perspective, develop relationships, and gain direct knowledge of ECC operations.

Background and historical information regarding each ECC are essential for context. It was critical to the success of this report to have discussions, develop a mutual understanding on topics deemed relevant for this report, and exchange information necessary to fulfill the requests of this report. This includes discussions with ECC staff, and in many cases, with cross-agency resources that collaborate to ensure efficient ECC operations. Though other ECC's exist in the country there was not enough time or resources to expand this report beyond these three longstanding Emergency Communications Centers.

## 2.3 Literature Review – Summary of Findings

To supplement the information gathered directly from each of the ECCs, a literature review was conducted to more broadly identify published research relevant to this topic. Numerous articles focusing on the development and implementation of regional and/or statewide trauma systems were identified, although many of these articles were published in the early-mid 2000s and do not specifically address communication centers established to support trauma systems. Relevant published literature generally fell into four categories:

1. Regional and State Trauma Systems
2. Communication Technologies and Emergency Medical Services (EMS)
3. Telemedicine and Emergency Medical Services (EMS)
4. Pediatric Emergency Medical Services (EMS)

***Regional and State Trauma Systems*:** The impact of the development and implementation of regional and/or State trauma systems was the focus of significant research during the 1990s and 2000s. Researchers examined the impact of coordinated trauma systems on patient mortality, hospital length of stay, and cost of care. Findings generally suggest that trauma systems lower patient mortality rates, reduce lengths of stay, and reduce costs of care. A more recent article that focuses specifically on a statewide trauma communication center (Arkansas) found it to be "effective in expediting the transfer process and thus reducing the time to definitive care for severely injured patients" (Porter et al, 2014).

***Communication Technologies and Emergency Medical Services (EMS):*** Journal articles, many of which examine communications technologies and systems used in Emergency Medical Services in Europe, focus on the evaluation of specific technologies and/or communications systems and protocols that facilitate the provision of emergency medical services during transport to hospitals.

***Telemedicine and Emergency Medical Services (EMS)*:** The use of telemedicine has increased across the world during the past few decades. However, very few studies examine the use of telemedicine in ambulances during emergency transport. Relevant articles focus on the evaluation of specific activities or medical procedures conducted in ambulances with telemedicine tools or remote guidance provided by medical staff at a partner hospital.

***Pediatric Emergency Medical Services (EMS):*** An area of interest within the EMS field is pediatric emergency medical services. Relevant articles discuss the application of new and

innovative telemedicine technologies and communication tools to better address the unique needs of pediatric EMS patients.

# Section 3 Emergency Communications Centers and Technology

The mission of an Emergency Communications Center (ECC) directly supports Emergency Medical Services (EMS) resources at State, regional and local levels.

## 3.1 The Role of Emergency Medical Services (EMS)

The mission of EMS is threefold: 1) Get to the patient quickly, 2) Fix what can be fixed and continue care while 3) EMS providers quickly get the patient to the right hospital. Anything that can be done to compress time periods of each of these goals is beneficial for the patient. Serious injury is a time-sensitive disease which depends on "getting the right patient to the right facility in the right amount of time." ECCs primarily focus on the third goal in the EMS mission.

Each State and territory in the United States has a lead EMS agency. These agencies are usually housed within State health departments, but in some States they may be housed within a multidisciplinary State public safety department, or they may be an independent State agency.

State EMS agencies are typically responsible for the overall planning, coordination, and regulation of the EMS system within the State, as well as licensing local EMS agencies and personnel. In the three ECCs examined for this report, the State EMS agency plays a role in the operational oversight, funding, governance, or procedural oversight of the ECC. The type of role of each State EMS agency varies.

Per the National Association of State Emergency Medical Services Officials (NASEMSO), the following are functions typically performed by State EMS agencies:

- Licensing of ground ambulance services, air ambulance services, and non-transporting emergency medical services;
- Training, certifying, and licensing Emergency Medical Technicians, Paramedics, and Emergency Medical Dispatchers;
- Promulgating statewide medical protocols for EMS providers, or otherwise establishing the scope of EMS practice within the State;
- Providing oversight of State trauma care systems;
- Managing poison control systems;
- Serving as the lead agency for statewide trauma systems, EMS for children, and other specialty care systems;
- Collecting data from local EMS agencies, hospitals, and trauma centers and monitoring system performance and outcomes;
- Managing statewide emergency medical services data systems;
- Helping to assure a broad base of financial support for the operation and maintenance of emergency medical services;
- Assuring that, in a changing health care delivery system, EMS continues to serve as the "safety net" for the community;
- Operating or setting standards for use of statewide communications systems that connect EMS providers in the field with hospitals, as well as trauma and specialty centers; and

- Preparing, planning for and coordinating the medical response and deployment of emergency medical resources to disasters and mass casualty incidents both intra- and interstate and homeland security medical initiatives.

The nature and role of EMS and statewide ECCs is evolving, and in many ways is driven by technology. There is an increasing overlap between emergency medical services, public safety, and public health. The State EMS agency assures the quality of a statewide coordinated, high quality emergency medical services system in order to protect the health and safety of the public.

The role of EMS in the operation of an ECC is critical, as there are existing Federal, State, regional and local systems and models that ECCs must support and operate within. Implementing an ECC within these existing systems would not be considered a build "from the ground up" type of effort. Rather, a new ECC would support, supplement, and expand upon existing EMS and trauma systems, infrastructures, and protocols already in place.

## 3.2 Emergency Communications Centers (ECCs)

ECCs are an integral part of the continuum of care and have a direct impact on the critical time between trauma and assistance, formerly known as the golden hour. For victims sustaining time sensitive injuries (e.g. internal bleeding, severe brain injury), this concept is particularly important.

ECCs are similar in concept to a Public Safety Answering Point (PSAP), commonly referred to as a 911 center. However, an ECC typically becomes involved only after a 911 center has dispatched first responders to an incident; the ECC then helps coordinate that response based on what the first responders find. PSAPs and ECCs are two distinct entities joined together by an event or emergency.

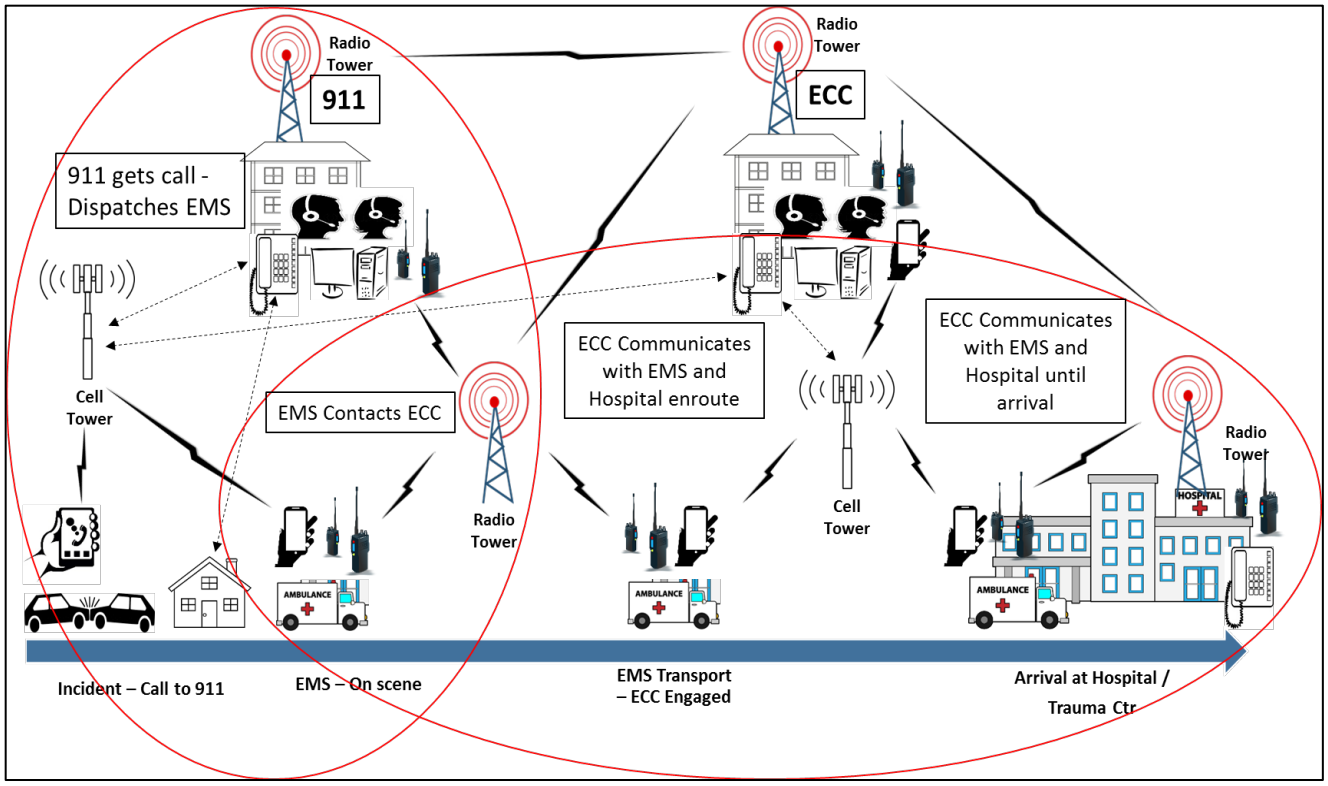


*Figure 1: ECC Diagram*

Each of the three ECCs examined in this report operates in conjunction with a Level 1 Trauma Center, associated with an academic hospital system. Each of these academic trauma hospital systems provides various forms and levels of resources, governance, authority, oversight, funding and operational support to the ECCs discussed here.

Trauma centers are select hospitals that provide a full range of care for severely injured patients 24 hours/day, seven days/week. The trauma care includes ready-to-go teams that perform immediate surgery and other necessary procedures for people with life-threatening injuries, for example, due to car accident, burn, bad fall, or gunshot.

A trauma system involves trauma centers working together with 911, Emergency Medical Technicians (EMTs), ambulances, helicopters, and other health care resources in a coordinated and preplanned way. This network of care is designed to move seriously injured people to the place with the most appropriate resources as quickly as possible. Trauma centers are designated as Level I, II, III, or IV, with Level I Trauma Centers providing the most comprehensive care. ECCs support the coordination and communication within the various levels of the trauma system and EMS providers, facilitating communication between trauma care providers, supporting and guiding emergency transportation decisions and actions, and in some cases, facilitating communication to provide medical guidance.

## 3.3 Types of Emergency Communications Technologies

Each of the three ECCs profiled here is reliant on communications technology to operate successfully. The technologies used are fairly consistent across the three sites; however

differences exist regarding how the technologies are provided, who provides them, how reliable they are, and who maintains the technologies.

The one common communications technology used in the Alabama, Maryland, and Mississippi ECCs is a radio system known as Land Mobile Radio Systems (LMRS). The LMRS are also used by first responders, as well as local, regional, and State entities supporting other critical services such as Emergency Management, 911, and Public Safety. Multiple radio systems are used within each ECC to link to numerous local, regional, and statewide systems to coordinate and communicate with first responders and other relevant service providers.

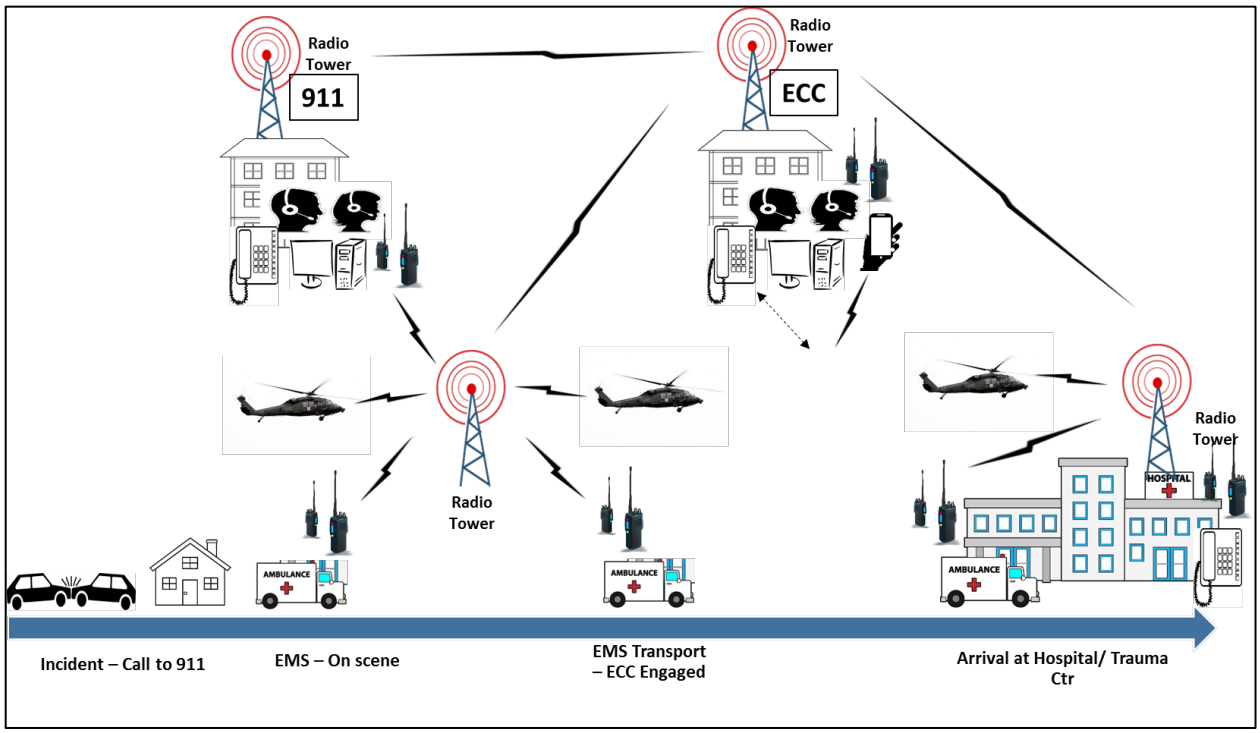


*Figure 2: Land Mobile Radios and ECCs*

The figure above demonstrates the extensive use of radio systems in the operation of an ECC, and connecting to 911 and local first responders. Common radio systems as well as other types of communications technologies used by ECCs are explored in sections 2.3.1 – 2.3.8 below.

### 3.3.1 Land Mobile Radio Systems (LMRS)

Land mobile radio systems (LMRS) in the ECC context include the traditional VHF and UHF dispatch-to-vehicle (mobile and portable radios), vehicle-to-vehicle, vehicle-to-hospital, and hospital-to-hospital (and other facility) communications.

They also include evolving 700 MHz and 800 MHz trunked radio systems in which ECCs are increasingly participating. These systems offer some level of data capacity in addition to voice communication. System hardware requirements are generally specific to the area's geography, budget, and communication goals.

LMRS are primarily useful for voice communications and simple telemetry or small data file transfer. Wideband communications can support more complex data file and biotelemetry communications, while broadband allows video and other bandwidth intensive applications.

#### *3.3.1.1 VHF Radio Systems*

VHF communications have formed one of two LMRS foundations for EMS communications since the 1970s. Frequencies are those traditionally used for ambulance-to-hospital or administrative/dispatch.

With the longest range of the frequencies typically used for EMS, VHF is still the predominant choice in frontier, rural, and suburban EMS systems. Range depends on power output of individual radios, antenna height, and any fixed or mobile repeaters used to bounce signals forward. Services opting into newer 700 and 800 MHz systems, or which use EMS UHF systems, typically maintain VHF capabilities for redundancy.

VHF radio systems are "simplex", which means messages can be sent only one-way at a time. This speed is slower than early "dial-up" internet connections and severely limits (or makes impossible) video, some telemetry, and other data communications EMS may want in the future.

#### *3.3.1.2 UHF Radio Systems*

The second 1970s communications foundation for EMS was UHF, used for ambulance-to-hospital voice and biotelemetry (EKG only), and for regional frequency coordination. These frequency ranges allow two-way or duplex conversations.

While UHF frequencies usually do not have the range of VHF frequencies, they are better for penetrating buildings. Mobile and fixed repeaters, and microwave systems, may be used to extend range and/or to create redundant regional communications loops.

Microwave relays extend the ranges of the radio system up to hundreds of miles by converting radio frequencies into telephone/microwave frequencies and back to radio frequencies on the receiving end. Microwave systems can accommodate a wide variety of radio systems for State and local emergency services, and for non-emergency services such as highway maintenance crews.

UHF frequencies offer only low-data transfer rates.

#### *3.3.1.3 700 MHz and 800 MHz Public Safety Trunked Systems*

The Federal Communications Commission (FCC) has designated 800 MHz public safety radio frequencies to be used in public safety trunked radio systems. The intent is to reduce interference with commercial wireless communications systems, which use a number of frequencies instead of one frequency. The FCC has also allowed such systems a narrow slice of spectrum in the 700 MHz range, though this is used less frequently for regional and statewide systems than is the 800MHz.

Trunked systems allow more efficient use of frequencies because a computer automatically searches for an open frequency when a call is made. Thus, the caller is not required to select a frequency manually each time, helping to prevent radio frequency congestion and interference.

In some areas with 800 MHz trunked systems, EMS agencies have opted to stay on VHF or UHF frequencies, while other public safety agencies have switched over to the 800 MHz frequencies.

A drawback to 800 MHz radio systems for rural areas is the limited range of these frequencies. Many more repeaters are needed to cover a given geographic area than would be required with lower band frequencies, which can significantly increase the cost of providing 800 MHz radio systems in rural areas.

Trunked systems offer increased data capabilities as compared to VHF and UHF, but are limited when compared to commercial options.

### 3.3.2 Landline Telephone Systems

EMS providers often utilize standard telephone service from patient homes and other sites. While physically limited in obvious ways, such communications offer privacy and operational protections. Used in conjunction with an Enhanced 911 system, caller phone and location information are provided automatically to emergency call-takers.

A disadvantage of landline telephone systems is the dramatic decrease in the existence of landline, fixed location telephones due to the adoption of cellular or wireless phones.

Landline telephone systems are primarily used for voice communications.

### 3.3.3 Cellular Telephone Systems

Cellular telephone use in EMS has become commonplace, largely because of the greater latitude it provides in conversations involving patient identification and other confidential information. In addition, the ability of "smart" phones to not only provide voice communication but to take and send photographs, videos, and other data files, and to access the Internet, makes them more powerful tools.

Additional advantages of cell phones for EMS include: an alternate means of communication in radio dead spot areas; ease of use; easy access to telephone systems; and duplex voice capabilities. Cell phones also provide mobile 911 emergency access and are increasingly able to pinpoint a caller's location automatically as location technology improves.

Disadvantages of cellular systems include: potential for overload during disaster situations; unreliable coverage in all geographic areas, particularly rural areas; and, in multi-unit or multi-agency responses. These systems can be operationally difficult to coordinate multiple cellular users in the field because different users cannot monitor each other's transmissions. Taking into account these limitations, cellular telephone is a good supplement to EMS radio systems, but would have significant limitations if relied upon exclusively.

### 3.3.4 2.4 to 5.9 GHz WIFI Systems

WIFI systems or wireless "hot spot" based ("mesh") systems are evolving rapidly in urban areas and along major highways. Many people are familiar with this technology, as it is common in private homes, offices, and business. These systems offer the advantage of very robust broadband voice and data communications. However, the disadvantage of requiring virtually "line of sight" connection between the communications device (e.g. PDA, laptop) and the "hotspot" connection or wireless router renders these systems prohibitively expensive outside of urban areas. Municipalities are turning to unlicensed 2.4 GHz mesh systems to provide citywide access to the Internet on a free or "pay-to-play" basis. To support the cost of building out the necessary infrastructure, leaders propose using these systems for EMS and public safety communications applications.

However, because these are unlicensed systems, access is open to any users, which suggests, but does not confirm potential interference, data transfer speed delays, and security/privacy issues.

### 3.3.5 IP Data Networks/Fiber Optic Connections

Fiber optic infrastructure is increasingly finding its way into rural schools, libraries, health centers, and other such facilities. In addition to the telemedicine/700 MHz connection mentioned earlier, very rural EMS providers requiring online medical direction involving multi-vital sign or other data transmissions may be able to physically connect 24/7 by driving to one of these facilities and linking by hotspot or locked wireline access to the fiber optic line for the length of the exchange.

### 3.3.6 Land Mobile Satellite Communications

In sparsely populated, remote rural areas, providing EMS radio system coverage can be very costly. Although expensive, land mobile satellite communications may provide a cost-effective alternative to terrestrial radio systems in rural areas. Several companies are now developing this technology. Some plan to use satellites in "fixed" geostationary orbits, while others plan to use multiple low-orbit satellites. These systems will use omni-directional antennas, more compact than the traditional satellite dishes that must be pointed at a satellite in a fixed point in the sky. Land mobile satellite communications systems offer voice and data options, although data options are costly. They are primarily used for voice communications with the ECCs when other options are unavailable.

### 3.3.7 FirstNet

The First Responder Network Authority (FirstNet) was created under the Middle Class Tax Relief and Job Creation Act of 2012 as an independent authority within the National Telecommunications and Information Administration (NTIA). The legislation assigns FirstNet the mission to build, operate, and maintain the first high-speed, nationwide wireless broadband network dedicated to public safety. FirstNet will provide a single interoperable platform for emergency and daily public safety communications.

This broadband network will fulfill a fundamental need of the public safety community, as well as the last remaining recommendation of the 9/11 Commission. FirstNet will bring 21st century tools to millions of organizations and individuals that respond to emergencies at the local, State,

Tribal and Federal levels. Through the assessment of fees, FirstNet must generate sufficient funds to enable the organization to operate, maintain, and improve the network each year.

To create a nationwide network, all 56 U.S. States and territories must have a radio access network that is connected to the FirstNet core network. To contain costs, FirstNet is tasked with leveraging existing telecommunications infrastructure and assets. This includes exploring public/private partnerships that can help support and accelerate the creation of this new, advanced wireless network.

FirstNet is governed by a 15-member Board consisting of the Attorney General of the United States, the Secretary of Homeland Security, the Director of the Office of Management and Budget, and 12 members appointed by the Secretary of Commerce.

FirstNet planning is underway to identify service providers and vendors to deploy the nationwide public safety broadband network.

### 3.3.8 Next Generation 911

For more than 40 years, the 911 system has served the needs of the public in emergencies. Next Generation 911 (NG911) will enhance the 911 system to create a faster, more flexible, resilient, and scalable system that allows 911 to keep up with communication technology used by the public. As the communications infrastructure evolves, hardware, software, governance, funding, authority, and training must keep updated to maintain the expectations of the public.

The vast majority of the nation's 911 call centers, or PSAPs, use analog equipment that cannot receive text messages, videos, or photos or certain calls from computers. Even worse, the location of calls made on a mobile device can be difficult for today's PSAPs to accurately pinpoint. At times calls overwhelm a call center — as during a natural disaster or even a vehicle crash. When this happens, outdated technology prevents calls from being transferred between centers or rerouted, which can leave citizens without needed aid.

Upgrading to Next Generation 911 (NG911) will transform an outdated public safety system into a digital network that is faster, more efficient, more cost-effective, and safer for the public and for law enforcement.

Put simply, NG911 generally involves the implementation of an Internet Protocol (IP)-based network that allows digital information (e.g., voice, photos, videos, text messages) to flow seamlessly from the public, through the 911 network, and on to emergency responders. This network is known as an Emergency Services Inter-Network (ESInet) and as of 2015, 911 centers across the country are starting to migrate to this new capability and mission critical applications will soon follow.

NG911 technologies can increase the reliability and scalability for continuity of operations for all public safety systems. By its very nature, NG911 can improve the ability to adapt to meet operational situations determined by a particular demand, disaster, or disruption of service. These capabilities flow from the flexibility and adaptability of modern networking technology.

As part of the public safety communication ecosystem, it is important that NG911 work seamlessly with the envisioned national public safety wireless broadband network, which will increase the amount of data available to first responders in the field. Interoperability between ECCs and NG911 systems will be required as NG911 systems deploy over the next several years.

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# Section 4 State Emergency Communications Center Profiles – Alabama, Maryland, and Mississippi

This section of the report provides the details, observations and conclusions related to each of the three statewide ECCs profiled for this report.

## 4.1 Alabama Trauma System and the Alabama Trauma Communications Center (ATS/ATCC)

The Alabama Department of Public Health (ADPH), Office of Emergency Medical Services (OEMS), is responsible for the Alabama Trauma System (ATS) and the administration and oversight of the agencies that operate six regional emergency medical systems in different geographic regions in the State of Alabama.

*Figure 3: Alabama Trauma System Logo*

The ATS involves numerous trauma centers working together with 911 agencies, emergency medical service personnel (EMSPs), ambulances, medical evacuation aircraft, and other health care resources in close coordination with the Alabama Trauma Communications Center (ATCC).

The ATS is designed to quickly move seriously injured people to a place with the most appropriate medical resources and capabilities to treat the patient, preventing a patient from going through a potentially lengthy hospital transfer process.

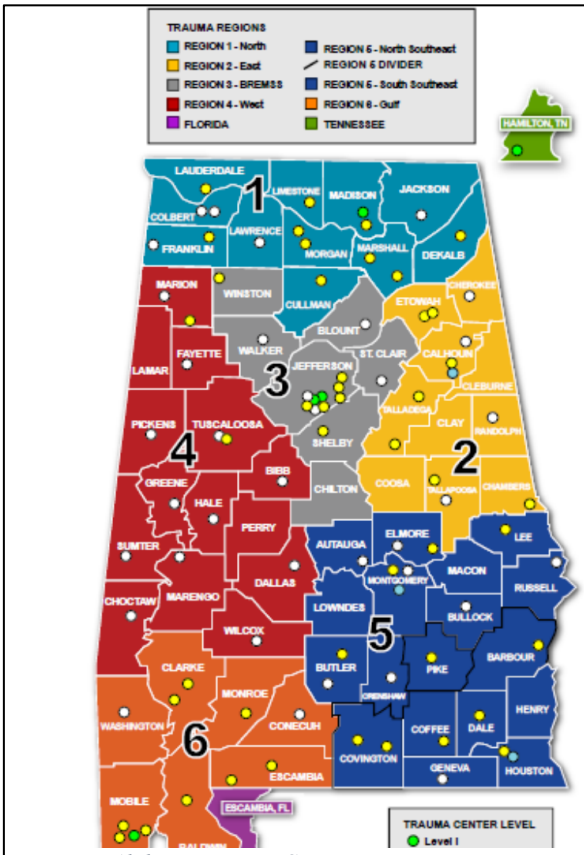


*Figure 4: Alabama Trauma System Regions*

ATS, with the capabilities of the ATCC, is one of the few State systems with the ability to constantly monitor the readiness status of every trauma hospital in the system in real time, and to route a trauma patient to the right hospital as their first destination. This system is unique among the three ECCs examined, in that it combines a purpose-built technology application, a real time status component, and an agency that has the authority to route patients system-wide based upon the technology.

As depicted in Figure 4, Alabama is divided into six emergency medical services system regions, each operating a Regional Emergency Medical Services System (REMSS.)

### 4.1.1 Background

The ATS is built around two key components, hospitals with Level 1 Trauma Centers and the Alabama Trauma Communications Center (ATCC), operated by contract with the Birmingham Regional Emergency Medical Services System (BREMSS).

The primary goal of the ATS is to have a Level I Trauma Center within a 45-minute drive of any location in Alabama. In this system, the majority of trauma system patients go to Level I Trauma Centers based upon real time status information managed and monitored at the ATCC. The Level II and III Trauma Centers receive less severe patients and provide backup when a Level I Trauma Center is unavailable.

The Alabama Legislature established a statewide trauma system in 2007 with the passage of Senate Bill 278. This bill effectively expanded upon what had been an existing regional system, the Birmingham Regional EMS System (BREMSS), to establish a statewide system administered by the State Board of Health. It also:

- Established the Statewide Trauma Advisory Council and provided for its membership and responsibilities,
- Created a statewide trauma registry required of all levels of trauma centers,
- Provided for regional trauma advisory councils, and
- Provided funding through the State Board of Health.

With this 2007 legislation, the Alabama Department of Public Health (ADPH) formed a partnership with BREMSS to create what is now known as the Alabama Trauma System. Funding from member hospitals and an ADPH grant supported the development and implementation of the Alabama Trauma Communications Center (ATCC), operated by BREMSS.

### 4.1.2 The Birmingham Regional EMS System (BREMSS)

The concepts of coordinating Emergency Medical Services across the State of Alabama were first introduced in the late 1960s using a combination of State, local, and Federal EMS funding to support EMS initiatives. The Birmingham Regional Emergency Medical Services System (BREMSS) was the first regional trauma system in the State, started in seven counties around Birmingham in 1996. BREMSS is an administrative component of the University of Alabama at Birmingham (Health System). Since its inception, BREMSS has included a communication and coordination component to support patient transfer to appropriate trauma care.


*Figure 5: BREMSS Logo*

The communications system that BREMSS operates and relies upon is modeled on a system first used in Portland and Multnomah County, Oregon in the 1980s and 1990s. It was one of the first regional systems to track trauma center status to determine the best options for EMS responders based on patient needs and hospital status. BREMSS has evolved with time to support patient routing/triage and the collection of data regarding activities and patient outcomes.

A study performed by a group at the University of Alabama at Birmingham (UAB) examined the performance of the BREMSS Trauma System in the late 1990s. The positive patient outcomes

demonstrated by the study were a major factor that led to expansion of the ATS/BREMSS concept throughout the state and the passage of legislation to support the statewide Alabama Trauma System.

BREMSS has also been recognized for its disaster response capabilities, with a positive review from the *Journal of Trauma* for its performance following a 1998 tornado that killed 32 people. In 2006, BREMSS was awarded the Mitretek Innovations Award in Homeland Security, a prestigious national award sponsored in part by Harvard University.

### 4.1.3 Alabama Trauma Communications Center – Alabama's ECC

All ATS patient routing, statewide, is managed by a single high-tech communication center that monitors the resources of every trauma center in the State and coordinates patient transport to the appropriate ready trauma center 24 hours/day, seven days/week, 365 days/year.

The ATCC is staffed by paramedic-trained dispatchers who field calls and monitor hospitals. Paramedics and emergency medical technicians in the field call in by phone or radio to the ATCC. ATCC dispatchers log the patient into the system and direct that EMS crew to the appropriate hospital based on the patient's level of injuries and the hospital's availability and capability to treat those injuries.

*Picture 1: Alabama Trauma Communications Center (ATCC)*

Day-to-day, only the most seriously injured patients -- based on a statewide protocol that paramedics are required to learn -- are called in to the ATS system. BREMSS operates the ATCC on behalf of the ATS. Approximately 12,000-14,000 calls are processed each year.

Like many ECCs, the ATCC employs a mix of communication systems, using radio, cell phone, and an intranet computer system that ties all hospitals and all major EMS transport agencies together in a system that is heavily dependent upon regional cooperation, planning, and implementation.

Figure 6 below represents a high level conceptual illustration of how the ATS/ATCC operates today.

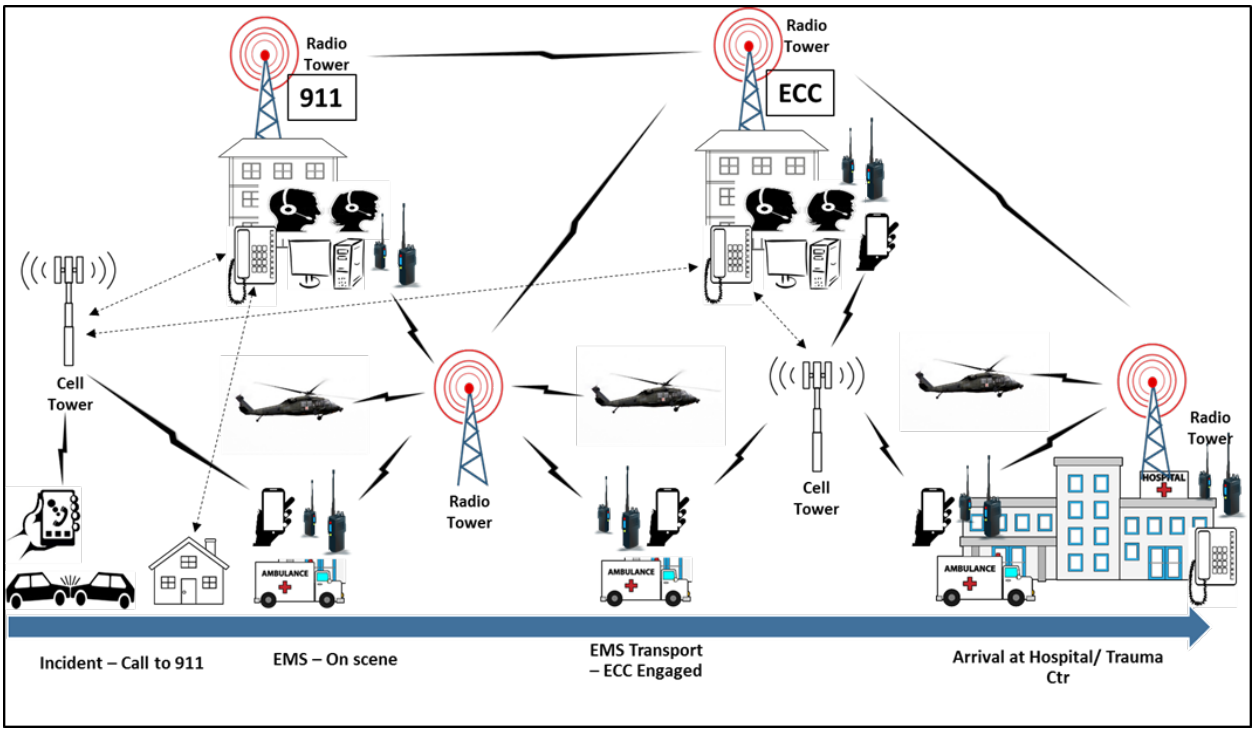


*Figure 6: AL-ATS-ATCC Diagram*

Trauma hospitals provide extensive patient, treatment, and patient outcome information to the ATCC trauma database to support the analysis of the statewide ATS program.

ATS has a repository of over 132,000 trauma patient records and outcomes accumulated since its inception. The data is used for prediction, modeling, and resource allocation; to inform continuing education; management reporting, including feedback regarding procedures, triage, program evaluation; and Quality Assurance/Quality Control of program support.

### 4.1.4 ATCC Technology

ATCC dispatchers use a secure computer system called LifeTrac, which is tied into 45 hospitals statewide. The system monitors and reports on each hospital's status in terms of beds, equipment, doctors, and critical care units. Monitoring of the trauma center resources is done through a computer intranet system. The ATCC also maintains status of participating trauma hospitals in bordering states.

The computer software used for the ATS intranet, database applications, and internal operations was developed in-house using off-the-shelf applications that are customized to meet Alabama's needs.

System data are used to recommend real time patient routing based on reported conditions and vitals from the field. The system also allows a hospital to determine when it is available to accept new patients and allows real time mass casualty triage in times of system overload.

Southern Link, a commercial 800 MHz radio system, is also commonly used for voice communications between field responders and the ATCC to exchange patient information and coordinate transport to the most appropriate trauma hospital.

*Picture 2: ATCC Real Time Status Monitor*

Radio communication resources are linked and accessed via Zetron radio dispatch console electronics at the ATCC, which allows patching between the field, the ATCC, and hospitals, as well as monitoring by local emergency communications centers and agencies.

### 4.1.5 University of Alabama Birmingham Study

As noted previously, a study performed by a group at the University of Alabama at Birmingham (UAB) examining the performance of the BREMSS Trauma System in the late 1990s was a major factor that led to establishment of the BREMSS/ATS concept throughout the State, and the passage of legislation to support its operation.

The UAB study assessed changes in mortality, length of stay, and cost of care at a large, Level I teaching hospital in the BREMSS area after the activation of BREMSS throughout the region.

The study statistically substantiated the effectiveness of the BREMSS program, including its well-staffed ATCC. The study found that between 1996 and 2005, there were over 23,000 patients treated for major trauma.

Outcome statistics from the study yielded a mortality rate reduction from 5.9 per 100 patients to 3.8 per 100 patients in the treatment group as compared to the control group; this represents a 36 percent decline in mortality overall. These findings are attributed to the implementation of the trauma system now used in Alabama.

The study further demonstrated that a voluntary system of this type can have a beneficial effect on the mortality rate of serious traumatic injury at Level I Trauma Centers and ultimately resulted in the application of the BREMSS model to the statewide trauma system used by the ADPH. While this study does not examine the specific impact the ECC on patient outcomes, it does document the impact that system wide coordination and communication have on patient outcomes.

### 4.1.6 Funding

The ATS, including the ATCC, is primarily funded by ADPH grants and financial support contributed by participating hospitals. ATS also receives funding from the State to support administrative costs.

Current State legislation indicates an annual allocation of $2 million to support the entire Alabama Trauma System. BREMSS operates with an annual budget of approximately $750,000, which includes the ATCC. Revenues are primarily derived from ADPH grants and approximately $400,000 from participating hospitals. Interviews with staff indicate funding is a serious challenge to sustaining and improving programs and services.

### 4.1.7 ATS/ATCC Observations and Conclusions

**ATS and ATCC Impact Mortality in Alabama.** Empirical evidence suggests that, as part of the statewide program, ATS and the operation of the ATCC combine to have a direct impact on patient outcomes and mortality, especially as it relates to EMS and hospital operations. ATS and the ATCC are crucial components of the response to a medical emergency in Alabama.

**Communications technologies play a critical role.** The use of, and continued adoption of, communication technologies enable ATS/ATCC to accomplish its mission. Serving as the critical patch between EMS first responders and hospitals in the trauma system is crucial; the system would not function efficiently without the technology.

**New communication technologies are having an impact.** The Alabama SouthernLink system radio project has had a significant impact on the ATC's communication technologies by providing additional infrastructure support and interfaces that support interoperable communications. Operation, control, and authority are not controlled by ATS/ATCC. This is consistent with the other ECCs examined in this report, and their use of State or other radio assets. The real time status component also ensures resource allocation and capacity issues are quickly considered during emergency response situations, and up-to-date information is provided to emergency response personnel.

NG911 is another area that may impact ATS/ATCC. The interoperability with the AL 911 centers is a continuing operational imperative. The ESInet portion of a NG911 system could be used to facilitate data and information relative to medical emergencies. Connection to and use of NG911 infrastructure will be required by ATS/ATCC.

**Cooperation, collaboration, and interoperability are important.** ATS/ATCC reinforced the importance of high level of transparency and leadership focused on collaboration among all elements of the system as a necessary ingredient to achieving success.

## 4.2 Maryland – The Maryland Institute for Emergency Medical Services System (MIEMSS)

The Maryland Institute for Emergency Medical Services Systems (MIEMSS) is a component of the Maryland Emergency Medical Services System. MIEMSS oversees and coordinates all components of



*Figure 7: MIEMSS Logo*

Maryland's statewide EMS system (including planning, operations, evaluation, and research), provides leadership and medical direction, conducts and/or supports EMS educational programs, operates and maintains a statewide communications system, designates trauma and specialty centers, licenses and regulates commercial ambulance services, and participates in EMS-related public education and prevention programs.

Consistent with Maryland law and guided by the State EMS Plan, the mission of MIEMSS is to provide the resources (communications, infrastructure, grants, and training), leadership (vision, expertise, and coordination), and oversight (medical, regulatory, and administrative) necessary for Maryland's statewide emergency medical services (EMS) system to function optimally and to provide effective care to patients by reducing preventable deaths, disability, and discomfort.

### 4.2.1 Background

The Maryland statewide EMS system had its origins nearly 50 years ago, when plans were developed in the mid-1960s to create a statewide EMS system and to transport serious trauma patients by Maryland State Police helicopter.

In 1973 the "Maryland Institute for Emergency Medicine" and a Division of EMS were established by executive order. Both entities were subsequently combined into the Maryland Institute for Emergency Medical Services System.

In 1993, MIEMSS became an independent state agency, governed by an 11-member EMS Board appointed by the Governor. A Statewide EMS Advisory Council (SEMSAC), comprised of representatives from organizations involved in providing emergency care services, was created to advise and assist the EMS Board.

Maryland is a regulated statewide EMS system. Since becoming an independent state agency in 1993, MIEMSS has worked to formalize the administration, regulation, and operation of the statewide EMS system, through statute and regulation.

The EMS Board has statutory oversight authority, while the MIEMSS Executive Director is statutorily responsible for coordination of all aspects and components of the system. MIEMSS is organized into departments that reflect the structure necessary to coordinate the statewide EMS system.

MIEMSS is also represented by statute with a permanent position on the State's Emergency Number Services Board, which oversees the funding of, and represents the interests of, the 911/PSAP agencies.

*Picture 3: MIEMSS HQ - SYSCOM*

The MIEMSS EMS Communications Engineering Department has responsibility for designing, installing, and operating the State's Emergency Medical Resource Centers (EMRCs) and Systems Communications (SYSCOM) Center, and for maintaining the EMS communications system.

Additional responsibilities include equipment purchasing, invoice payment, shipping, receiving, inventory control and telephone services. The department has 100 employees that staff the EMRCs and SYSCOM, and nine technical support staff that support EMS communications and network equipment and infrastructure

### 4.2.2 MIEMSS Statewide Communications System

The MIEMSS Statewide Communications System is a complex network that provides communications among ambulances, medevac helicopters, dispatch centers, hospital emergency departments, trauma centers, specialty referral centers, and law enforcement.

The EMS communication system—one of the first statewide systems in the country—is maintained by MIEMSS and integrates the entire EMS system in Maryland. Through the use of radio and microwave technology, the statewide communication system links ambulances, helicopters, and hospitals and allows communication between system components at any time. The Communications System operates 24 hours/day, seven days/week, and 365 days/year.

### 4.2.3 Emergency Medical Resource Centers (EMRCs)

State EMS communications and resource management began in Baltimore in the 1970s and expanded to western counties and to the D.C. metropolitan area in the 1990s. There are currently four regional centers that support the mission of MIEMSS and use the EMS communications system to operate.

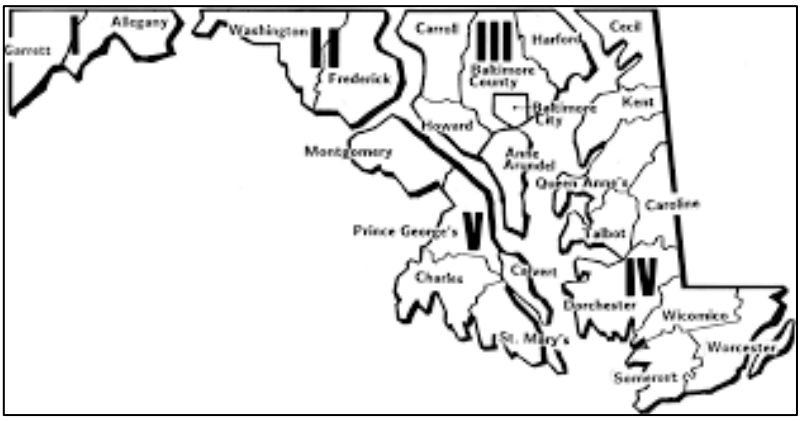


*Figure 8: MIEMSS Regions*

Each Emergency Medical Resource Center (EMRC) coordinates medical consultation between medic units and hospital physicians.

Hospitals are notified of patients being transported to their emergency departments. Medic units requesting a medical consult can call the EMRC, where operators instruct them to switch over to an available med channel to be patched through to a hospital.

While en-route to the receiving hospital, pre-hospital providers transmit patient information to an online hospital physician. Physicians may direct the pre-hospital provider to follow specific medical protocols and give them approval for additional treatment.

EMRC operators maintain a computerized status of all hospitals in the region. The system is known as CHATS (County Hospital Alert Tracking System). The operator provides notification of changes to a hospital's status to the affected jurisdictions. The CHATS information is also available via the internet from the MIEMSS website. With this system, hospital capacity to receive emergency patients and availability of resources is tracked in real-time.

In FY 2014 the Maryland Emergency Medical Resource Centers handled 203,616 telephone calls and 156,105 radio calls. Of these 359,721 calls, 125,501 were communications involving a patient or incidents with multiple patients, while 10,553 of these calls involved online medical direction.

### 4.2.5 SYSCOM – Maryland's ECC

By statute, MIEMSS is responsible for medevac helicopter communications. All medevac helicopters transporting patients to/from medical facilities within Maryland are required to communicate with the Systems Communications Center (SYSCOM). Helicopter radio communication sites are located across 95% of the state to ensure reliable radio coverage.

*Picture 4: MIEMSS SYSCOM Operations*

In FY 2014 the SYSCOM handled 21,308 telephone calls and 1,185 radio calls. Of these 22,493 calls, the majority related to requests for medevac helicopters

There is a Maryland State Police (MSP) Aviation duty officer stationed in SYSCOM. The MSP officer has primary responsibility for dispatching MSP helicopters and, if needed, coordinating the dispatch of U.S. Park Police helicopters for medevac operations. MIEMSS also works with commercial air ambulance services in Maryland to provide for the use of those resources and services in the event that the MSP helicopters are unavailable or significantly delayed in their ability to respond.

A flight following system in SYSCOM provides visual awareness of the status and location of all MSP helicopters. The system allows the MSP duty officer to locate and dispatch the nearest helicopter to the scene of an incident.

Figure 9 below represents a high level conceptual illustration of how SYSCOM and the EMRCs in Maryland operate today. This is consistent with other ECCs observed, with the addition of medevac dispatching.

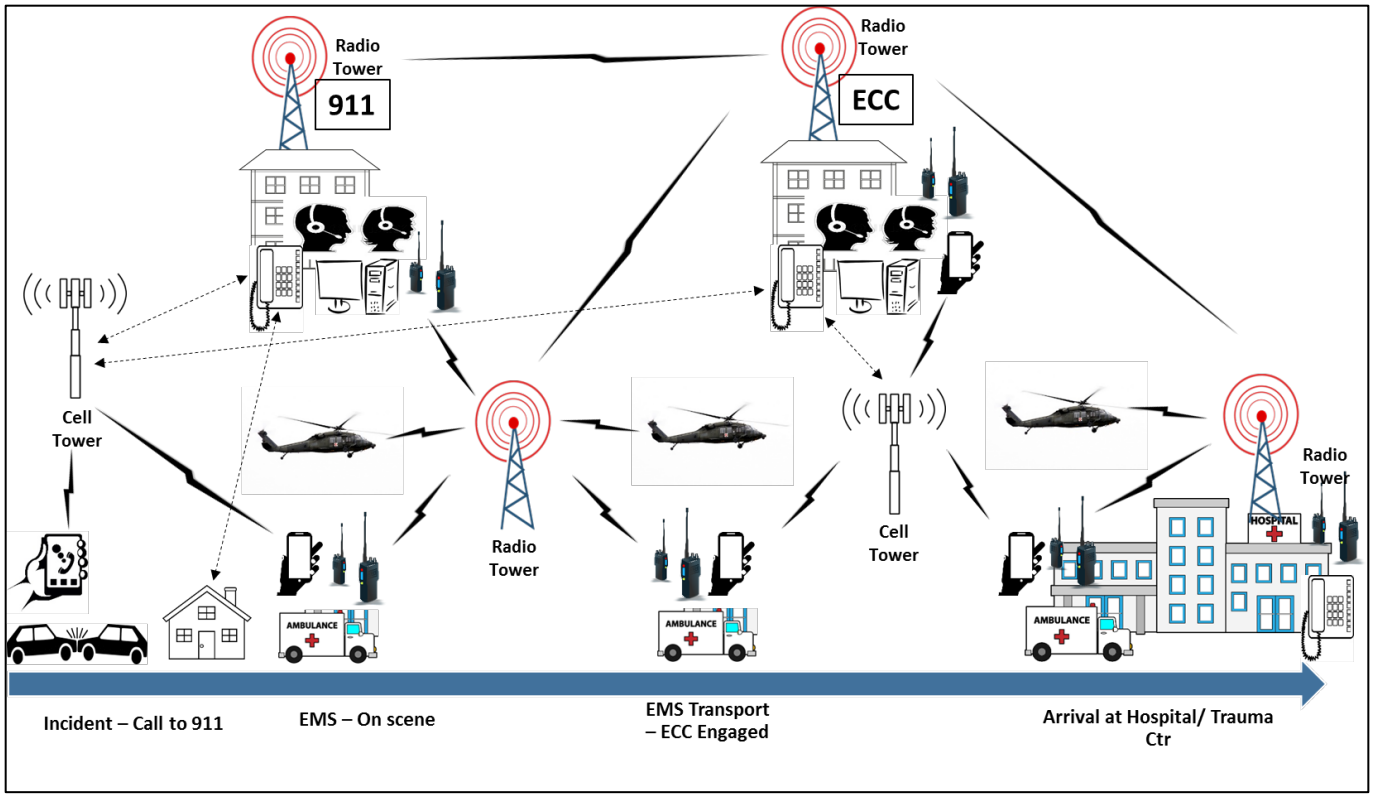


*Figure 9 - MIEMSS Diagram*

### 4.2.6 MIEMSS Communications Technologies

Land mobile radio (LMR) systems are the most vital components for providing emergency medical services in the state of Maryland.

Maryland's EMS communications reflects the national trends. The MIEMSS statewide communication system involves the EMRCs, SYSCOM, hospitals, 911 Centers, local providers, neighboring Federal, State, and local agencies. MIEMSS depends on the following primary technologies/systems:

- MIEMSS Public Safety Microwave System
- Statewide UHF Medical Radio Systems
- Maryland FiRST, statewide 700 MHz interoperable radio system
- Public Safety Interoperability network (PSINet)
- Digital EMS Telephone System (DEMSTEL)

All of these systems are currently undergoing significant upgrades, improvements, and replacement efforts to improve infrastructure and technical capabilities, and to transition next generation capabilities. MIEMSS technology activities focus on:

- Eliminating single point failures
- Providing geo-diversity

- Eliminating unsupported technologies
- Providing for "Next Generation" voice and data capabilities
- Increasing the utilization of PSINet and DEMSTEL infrastructure improvements and upgrades
- Integrating statewide communications with Maryland FiRST, statewide 700 MHz interoperable radio system
- Allowing for the development of a true backup capability for EMRC/SYSCOM

The following sections describe each of these primary technologies/systems.

#### *4.2.6.1 MIEMSS Public Safety Microwave System*

MIEMSS maintains the Statewide Public Safety Microwave System. In addition to supporting the EMRCs and SYSCOM, this system/network backbone supports all State agencies and many of the county radio systems involved in EMS communications, including the majority of communications among ambulances, medevac helicopters, dispatch centers, hospital emergency departments, trauma centers, specialty referral centers, and law enforcement.

The Public Safety Microwave System consists of 320 Digital Point-to-Point microwave hops at 166 locations throughout the state. It transports all EMS circuits on bandwidth shared with public safety partners, including Maryland's 700 MHz Public Safety Radio System (MFiRST), Network Maryland.

#### *4.2.6.2 Statewide UHF Medical Radio Systems*

The statewide UHF radio systems consist of 10 nationwide frequency pairs set aside for medical communications. The system consists of 254 Base Stations located at 69 Sites throughout the state. The UHF system is organized by EMS Administrative Regions and is heavily utilized by the four EMRCs. Each of these centers has multiple UHF Call Channel and Med Channel access and control used for medical patching for 911 and dispatch centers, local responders, and hospital and other medical resources.

In addition, MIEMSS SYSCOM at the Region III and Region V EMRCs in Baltimore also uses two low band radio systems for Command and Control and Medical Consulting for its helicopter operations. The MIEMSS communication systems are interconnected with the majority of the local county-based trunked Public Safety radio systems throughout the state, which provides the end users the flexibility to natively receive medical direction.

#### *4.2.6.3 Maryland FiRST, Statewide 700 MHz Interoperable Radio System*

Maryland FiRST 700 MHz is currently being implemented in phases across the State as a "state of the art" digital communications system. This is designed to serve all State agencies as well as local jurisdictions that choose to partner to support interoperability in emergency communications. The goal of the new system will be to provide first responders in every region in Maryland access to a fully digital, trunked radio system that all response partners can access in order to transmit and receive voice and data.

Maryland FiRST will share tower and microwave infrastructure with the infrastructure resources used by MIEMSS and other regional and local jurisdictions to provide and coordinate EMS services throughout the state. It will interface with the statewide UHF Medical Radio System and will completely replace the statewide Low Band Radio Systems currently used for helicopter medevacs and air to ground operations.

#### *4.2.6.4 Public Safety Interoperability Network (PSINet)*

The Public Safety Interoperability network (PSINet) is a statewide, private IP-based public safety network composed of fiber, microwave, and wireless links supporting critical data and voice communications. It is managed by the MIEMSS Communications Engineering Department.

The PSINet supports critical data and voice communications used by MIEMSS and the EMRCs including CHATS and FRED. It is also deployed to MSP Barracks, jurisdictional emergency operations centers (EOCs), and primary/back-up PSAPs/911, state and jurisdictional health departments, hospitals, and other allied agencies.

Interoperability applications currently operating on PSINet include Maryland FiRST, Digital Emergency Medical Services Telephone (DEMSTEL), and a variety of the State's regional voice and data networks. It is also used for the Electronic Maryland Ambulance Information System, Maryland Incident Management Interoperability Communications System (MIMICS), Maryland Law Enforcement Information Network (MLEIN), and systems monitoring/controlling the State's public safety microwave network and tower infrastructure.

MIEMSS is continuing to expand PSINet and DEMSTEL to a wider number of public safety locations. Currently PSINet is deployed to 77 hospital locations, 35 law enforcement locations, 57 health locations, 60 emergency management locations, and 3 transportation locations.

#### *4.2.6.5 Digital EMS Telephone System (DEMSTEL)*

The Digital EMS Telephone System (DEMSTEL) is a private VoIP telephone system that runs on the private Public Safety Interoperability Network (PSINet), permitting multiple public safety and allied agencies to communicate during routine and emergency events. This system operates independently of the public switched telephone network (PSTN) and commercial wireless carriers.

DEMSTEL is primarily used by EMS providers to call SYSCOM to request and coordinate medevac helicopter response, to arrange communications with hospitals in adjacent counties or other regions, and to coordinate inter-county mutual aid efforts. DEMSTEL continues to expand with the PSINet to support additional public safety entities.

### 4.2.7 Funding

As a State agency, MIEMSS faces funding challenges as they relate to keeping up with the latest in communications technologies. MIEMSS has faced, and continues to face, challenges regarding sustaining and improving its use of technology to support pre-hospital emergency response and EMS services in general.

Much of the technology used by MIEMSS requires maintenance, support, service and upgrades in order to meet the reliability and redundancy requirements of the system. Funding for maintenance, as well as for the purchase and implementation of newer, contemporary technologies and infrastructure have been challenging.

MIEMSS has recently undertaken major efforts to migrate from analog to digital technologies, and to improve the reliability of the major systems and networks they rely upon. Federal funding has provided critical support for major upgrades to the PSINet and DEMSTEL systems, and the efforts to extend their reach to additional agencies and resources.

The most recent annual technology budget for MIEMSS was approximately $1.2 million/year with approximately $800,000, or 67% of that budget representing recurring operating costs.

### 4.2.8 MIEMSS Observations and Conclusions

**MIEMSS and SYSCOM Impact Mortality in Maryland.** Anecdotal evidence suggests that, as part of the statewide EMS program, MIEMSS and the operation of EMRCs and SYSCOM combine to have a direct impact on mortality, especially as it relates to EMS and helicopter medevac operations. As is consistent with the other ECCs observed in this report, MIEMSS, the EMRCs and SYSCOM are crucial components of the response to a medical emergency in Maryland.

**Communications technologies play a critical role.** The use and continued adoption of communication technologies enable MIEMSS to accomplish its mission. Serving as the critical patch between EMS first responders and hospitals in the trauma system is crucial and the system would not exist without the technology.

**New communication technologies are having an impact.** The Maryland FiRST statewide radio project has had a significant impact on MIEMSS communication technologies by providing additional infrastructure support and interfaces that support interoperable communications. Operation, control, and authority are not controlled by MIEMSS. This is consistent with the other ECCs and their use of State radio assets.

NG911 is another area that will impact MIEMSS. The interoperability with the MD 911 centers is a continuing operational imperative. The ESInet portion of a NG911 system could be used to facilitate data and information relative to medical emergencies. Connection to and use of NG911 infrastructure will be required by MIEMSS.

**Cooperation, collaboration, and interoperability are important.** MIEMSS reinforced the importance of high level leadership and collaboration by MIEMSS through active participation in Statewide Boards, Committees, and the State's IT Department as necessary ingredient to achieving success.

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## 4.3 Mississippi MED-COM

The mission of the Mississippi Trauma Care System is to develop and maintain a statewide trauma system to ensure that Mississippians receive the highest quality of care possible, to provide a continuum of care from initial injury detection through definitive care including rehabilitation, and to decrease injury and death due to traumatic injury.

Section 41-59-5 (5), Mississippi Code of 1972, as amended, established the Mississippi State Department of Health (MSDH) as the lead agency to develop a uniform, non-fragmented, inclusive state-wide Trauma Care system, that provides excellent patient care.


*Figure 10: Mississippi Trauma System Logo*

MSDH was assigned the responsibility for creating, implementing, and managing the statewide trauma care system. The department develops and administers trauma regulations that include, but are not limited to, the Mississippi Trauma Care System Plan, trauma care system standards, trauma center designations, field triage, inter-facility trauma transfers, EMS aero-medical transportation, trauma data collection, trauma care system evaluation, and management of state trauma systems funding.

The department facilitates the implementation of professional and lay trauma education programs. The State Board of Health is authorized with the Emergency Medical Services Advisory Council and the Mississippi Trauma Advisory Committee acting in advisory capacities, to administer the disbursements of funds according to adopted trauma care system regulations.

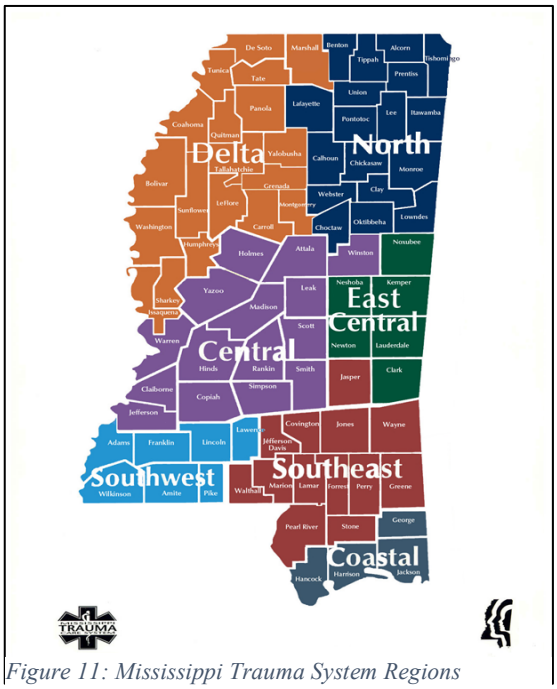


*Figure 11: Mississippi Trauma System Regions*

With the passage of House Bill 1405 during the 2008 legislative session, Section 41-59-5 was amended to make participation in the Trauma Care System mandatory for eligible acute-care facilities. The mandatory Trauma Care System became effective on September 1, 2008.

Mississippi's trauma care system is regionalized into seven (7) Trauma Care Regions as depicted in Figure 11. Each region has a Board of Directors that acts as the administrative body of that region. Region administration requires a regional trauma care plan. Once approved and included in the State Trauma System of Care Plan, the regional trauma plans are binding on all EMS providers and designated Trauma Centers within the respective region.

The Department executes a yearly contract with each Trauma Care Region. Through this contract, the regions execute the administration of the region, including: disbursement of Trauma Care Trust Fund distributions to Trauma Centers and EMS providers; assisting Trauma Centers with initial and renewal applications; and the regional Performance Improvement process.

There are approximately 91 hospitals participating in the Mississippi Trauma Care System: 4 Level I Trauma Centers, 3 Level II Trauma Centers, 15 Level III Trauma Centers, 61 Level IV Trauma Centers and one Burn Center. Fifty-eight ground and 17 air EMS providers service the 82 counties in Mississippi.

### 4.3.1 Background

A crucial component of the Mississippi Trauma system is the Mississippi Medical Communications Center or Mississippi MED-COM. Mississippi MED-COM is an advanced communications center providing support services to emergency response agencies, hospitals, and first responders in Mississippi.

Mississippi MED-COM was designed and implemented based on lessons learned from Hurricane Katrina in 2005 to support the Mississippi State Department of Health. Initial grant funding was provided through the U.S. Department of Health and Human Services Assistant Secretary for Preparedness and Response (ASPR) through the Mississippi State Department of Health to purchase the communication equipment and infrastructure for the center.

Mississippi MED-COM was developed after a review of twenty-six other medical communication centers across the country. Mississippi MED-Com staff visited each of the centers and used many of the best practices identified in these centers, adapting them to meet Mississippi's specific needs.

### 4.3.2 University of Mississippi MED-COM – Mississippi's ECC

Mississippi MED-COM is staffed 24 hours/day, seven days/week, 365 days/year with experienced paramedics and emergency medical technicians ready to serve the needs of emergency responders and healthcare providers statewide, during routine operations and in support during disasters.


*Figure 12: Mississippi MED-COM Logo*

Located on the campus of the University of Mississippi Medical Center (UMMC), Mississippi MED-COM is primarily supported by University of Mississippi funding. Mississippi MED-COM averages 6,000 calls for assistance a month and provides a single point of contact for over 1,000 emergency transfers into the UMMC and tertiary care facilities in Mississippi and neighboring states.

Mississippi MED-COM employs17 full-time and 4 part-time staff members. MED-COM is managed by a Clinical Director and a Medical Director.

### 4.3.3 Mississippi MED-COM Technology

Mississippi MED-Com is equipped with multiple levels of interoperability and real-time information sharing through resources such as the Mississippi Hospital Association's satellite radio system, the National Warning System (NAWAS), UHF/VHF and amateur radio, as well as multiple redundant systems.

*Picture 5: Mississippi MED-COM Call Floor*

Mississippi MED-COM has strategically placed emergency direct dial phones across the state in hospitals and dispatch centers for use with day-to-day operations, as well as, for disaster support situations. By incorporating this disaster system into day-to-day operations, the users are familiar with the system to facilitate its use during such disasters.

Additionally Mississippi MED-COM monitors radio frequencies for fire departments and law enforcement agencies in the regional area around University of Mississippi Medical Center. This enables the first responders to have ready access to UMHC's AirCare 1 and 2, and also enables the MED-COM center to provide early notification to the adult and pediatric emergency departments. This allows for better continuity of care and assurance that the patients get directed to the services and hospitals that can manage their injuries in a quicker, more efficient manner.

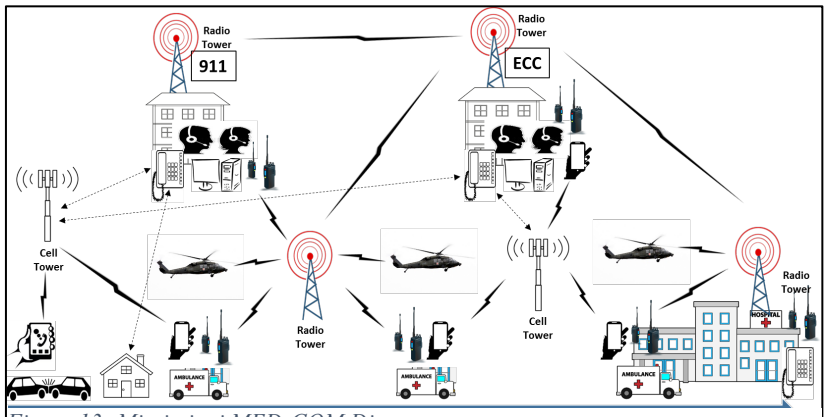


*Figure 13: Mississippi MED-COM Diagram*

Figure 13 represents a high level conceptual illustration of how the Mississippi MED-COM operates today. This is consistent with other ECCs observed.

#### *4.3.3.1 PSAP/911 Technology Deployed*

In 2011, Mississippi MED-COM purchased a commercial six position Public Safety Answering Point (PSAP) or 911 system to handle emergency calls coming from a variety of locations. This system is comprised of:

- Zetron 3300 call taking equipment
- Datamaster standalone ALI database
- Golden Hour CAD system
- MCC7500 radio dispatch consoles

The six radio dispatch consoles operate primarily on the MSWIN P-25 trunking system, which provides direct, secure, interoperable connections with nearly 30,000 users with Federal, State and local public safety agencies.

The CAD system allows Mississippi MED-COM the ability to process calls for service from responders and hospitals and record activities associated with providing those services.

The in-house ALI database allows common places, telephone numbers, and service locations to be automatically routed to specific communications specialists best able to provide a particular type of assistance or coordination.

MED-COM also has access to systems such as the State-Wide Medical Assets Resource Tracking Tool (SMARTT), which provides access to hospitals in the State and their bed status, services offered, and disaster preparedness status.

#### *4.3.3.2 Mississippi Wireless Information Network - MSWIN*

Mississippi MED-Com was one of the first users of the Mississippi Wireless Information Network (MSWIN) radio system used by state agencies and public safety groups in emergencies. The system provides seamless interoperable emergency communication coverage throughout the State. Mississippi MED-Com works to ensure that all public health and safety providers have access, resources and support as they treat and care for patients throughout Mississippi.

In April 2010, the Executive Office of the Governor established a public/private partnership, which submitted and was awarded a grant under the National Telecommunications and Information Administration's Broadband Technology Opportunities Program (BTOP).

The 2010 BTOP grant dedicated over $70 million for the expansion of the wireless broadband network to public safety agencies, emergency medical services and hospitals throughout Mississippi. A significant component of this grant has already been applied to add broadband wireless coverage to 97% of the state of Mississippi through the expansion of the Mississippi State Wireless Information Network (MSWIN) which is a 700MHz radio system deployed throughout Mississippi.

The MSWIN system is designed to provide a robust, integrated and secure medical communications platform. The platform will eventually allow over three hundred ambulances the ability to transmit secure images, streaming video and patient telemetry to secure portals.

### 4.3.4 Governance

Mississippi MED-COM is unique of the three ECCs studied here, in that its governance and authority is not as closely tied to the State as are the Alabama and Maryland systems. Mississippi MED-COM was created based on a need identified during a natural disaster. Emergency management capabilities were lacking when Hurricane Katrina hit the Mississippi coast.

State statute identifies funding that partially pays for Mississippi MED-COM, required the development of a trauma system, and allowed for core components to be overseen by the MDPH. However, while Mississippi MED-COM operates in close coordination with several State agencies including the Emergency Management Agency, Department of Health, Emergency Medical System, and the Department of Public Safety, it is governed by the University of Mississippi Medical Center. All operations follow all guidelines and policies of UMMC regarding daily operations, patient confidentiality and compliance.

Use of the Mississippi Wireless Information Network (MSWIN) is based on the governance of the Mississippi Wireless Commission (WCC).

### 4.3.5 Funding

Mississippi MED-COM's operational funding source is the UMMC. UMMC receives a funding allocation from the Mississippi Trauma Care Systems Fund authorized by the legislature to help fund the State's Trauma Care System.

Mississippi MED-COM's operational funding for FY 2014-2015 is approximately $1.2 million. Capital funding thus far has been via a 2007 HRSA grant to build the center and funds from the State's 2010 Broadband Technology Opportunities Program (BTOP) grant.

MED-COM is currently seeking grant funding to develop a standards-based LTE mobile EMS telemedicine system. The grant is currently in negotiations with FirstNet and the Department of Commerce.

### 4.3.6 Mississippi MED-COM Observations and Conclusions

**Mississippi MED-COM Impacts Mortality in Mississippi.** Anecdotal evidence suggests that, as part of the statewide trauma system, Mississippi MED-COM and the operation of the ECC combine to have a direct impact on mortality, especially as it relates to EMS and helicopter medevac operations. As is consistent with the other ECCs observed in this report, Mississippi MED-COM is a crucial component of the response to a medical emergency in MS.

**Communications technologies play a critical role.** The use and continued adoption of communication technologies enables Mississippi MED-COM to accomplish its mission. Serving as the critical patch between EMS first responders and hospitals in the trauma system is crucial and the system would not exist without the technology.

**New communication technologies are having an impact.** BTOP grant funding that created systems like MSWIN, the statewide radio project, has had a significant impact on Mississippi MED-COM communication technologies by providing additional infrastructure support and interfaces that support interoperable communications.

Operation, control, and authority are not controlled by Mississippi MED-COM. This is consistent with the other ECCs and their use of state radio assets.

NG911 is another area that will impact Mississippi MED-COM. The interoperability with the MS 911 centers is a continuing operational imperative. The ESInet portion of a NG911 system

could be used to facilitate data and information relative to medical emergencies. Connection to and use of NG911 infrastructure will likely be required by Mississippi MED-COM.

**Cooperation, collaboration, and interoperability are important.** Mississippi MED-COM is indicative of the level and complexity of cooperation and collaboration necessary to operate in a statewide trauma system.

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# Section 5 Additional Findings

This report examines three distinct Emergency Communication Centers (ECCs) operating in three different states. However, it would be remiss not to report that other State and Regional ECCs are operating across the country.

In addition to Alabama, Maryland, and Mississippi, emergency/trauma communication centers support statewide or regional trauma systems in Arkansas, Idaho, Oregon, and Louisiana. These facilities play a critical role in pre-hospital care, relaying information between first responders and receiving hospitals. Like the three centers described in this report, ECCs leverage communication technologies to coordinate patient transport and hospital admissions based on scene location, hospital status, patient injuries, and other relevant information, possibly including traffic and weather conditions.

These centers are also typically equipped to coordinate emergency services during hazardous materials incidents, natural disasters, and mass casualty incidents. While ECCs provide guidance and large-scale logistical coordination to EMS responders with regards to trauma patients in general, States and regions have also identified a need for medical and logistical guidance that specifically focuses on pediatric trauma patients, both in pre-hospital and hospital settings.

Pediatric trauma centers have been developed to address the specific needs presented by pediatric patients. However, due to more limited needs and finite resources, significantly fewer pediatric trauma centers exist.

According to the 2011 National EMS Assessment, only 8.2% of EMS events involve pediatric patients and only 28% of hospitals are recognized as having the capability of caring for pediatric trauma patients. In order to support EMS providers and Emergency Department physicians responding and attending to emergencies and critical care involving pediatric patients, most often in rural areas, virtual pediatric trauma centers and/or services have been developed.

The focus is on the use of telemedicine to provide consultations during the provision of emergency, trauma, and critical care for pediatric patients, particularly in rural communities. Based on information gathered from EMS providers nationwide, the majority of EMS service providers “always” or “almost always” communicate with a higher medical authority, usually a physician, regarding emergency pediatric treatment, when necessary.

In some cases medical guidance and logistical support regarding pediatric trauma patients is facilitated within the ECC model. In other cases, where ECCs do not exist, this guidance is an additional resource that is accessible to EMS providers independently, typically through existing pediatric trauma centers.

# Section 6 Observations and Conclusions

**ECCs are critical components of larger trauma systems**
The Alabama, Maryland, and Mississippi ECCs are each a critical component of the trauma systems deployed in their States, supporting day-to-day trauma triage, as well as mass casualty emergency response, management, and coordination when necessary. Additional similarities include:

- Each initially started as a smaller or regional service, then expanded statewide with statutory authority.
- Each expanded incrementally, as trauma systems expanded.
- Technologies deployed have advanced over time.
- Each, in some fashion, built upon regional, State, and Federal programs over the past 30-40 years that provide cooperative frameworks designed to serve the patient.

**Communications technologies are crucial to the operations of an ECC**
The application of communications technology, both new and old, has and will continue to have an impact on mortality rates in States that have implemented some model of an ECC. A few studies suggest that the deployment of an ECC, operating in support of a formally established trauma system, also furthers the capabilities of a trauma system in reducing mortality rates.

The operation of an ECC is fully dependent upon different types of communications technologies, both old and new. FirstNet and Next Generation 911 will likely impact ECCs and may provide opportunities for ECCs to implement more services and, as mentioned above, the opportunity to incorporate themselves into those networks, and take advantage of those technologies..

The Alabama, Maryland, and Mississippi ECCs are each tied to State and local radio systems that also interconnect to first responders, emergency management, and hospital/treatment facilities.

**Public / Private and Public / Public Partnerships are vital**
Public / Private and Public / Public partnerships play key roles in each of the ECCs observed. Communicating and coordinating across multiple entities is a primary focus of an ECC. Partnerships are critical to ensuring this communication and coordination is effective. Partnerships between multiple public and private entities address numerous issues, including funding, staffing, infrastructure, capital costs, operating costs, regulation, governance, certification, systems processes and procedures, training, and authority.

**Funding and 'keeping up' are major challenges**
Ongoing funding for the purchase, operation, maintenance, and support of communications technology is the major consistent and common challenge facing all three ECCs examined. As technology rapidly advances, the purchase and implementation of new technologies and system-wide updates are costly and logistically challenging.

To address this challenge, Maryland, uses a methodology primarily focused on owning and operating the essential technologies, while Alabama and Mississippi have adopted a methodology of using service-based or contract-based arrangements.

Beyond the immediate communication and coordination of EMS services, it is essential for an ECC to align with the interoperable communications technologies deployed by other responding agencies like 911 and State radio systems. In some cases it is possible to leverage resources to achieve this alignment, which is necessary for successful operations.

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# Section 8 Attachments

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Attachment A ECC Literature Review

# Emergency Medical Communication Centers
# Summary of Literature Review Findings

## Introduction

The Department of Transportation National Highway Traffic Safety Administration (NHTSA) Office of Emergency Medical Services believes that improved pre-hospital emergency response is vital to reducing mortality on America's highways and interstates, particularly in rural States, where deaths per capita are highest.

Providing high-quality emergency response, including the deployment of technology platforms that improve communications and speed transmission of data, photo images and real-time video to a remote trauma center may improve outcomes and save lives.

NHTSA is currently researching the topic of emergency medical communication centers to identify:

- models of regional and statewide medical communications centers,
- the mechanisms by which these models could be integrated into existing emergency medical services and trauma systems, and
- the potential ability of medical communications centers to use evolving and innovative digital technology to reduce traffic fatalities.

A literature review was conducted to examine the research that has been published that may be relevant to this topic. This document provides a summary of the findings of the literature review.

## Methodology

A literature review was conducted July 2015 to identify published materials focused on medical communication centers, the use of emerging communications technologies in emergency medical services, the use of telemedicine in emergency medical services, and pediatric emergency medical services. This literature review identified and examined materials published nationally and internationally, including peer-reviewed articles as well as industry publications and general media publications.

The following databases were queried:
*Academic Search Complete*
*PubMed*
*ScienceDirect*
*HealthSource: Consumer Edition*
*HealthSource: Nursing/Academic Edition*
*MasterFILE Premier*
*Medline*
*LexisNexis Academic*

Numerous search terms were utilized, including combinations of the following key search terms:
EMS
Emergency Medical Services
Pre-Hospital
Telemedicine
Mississippi MED-COM
Emergency Communication Center
Medical Communication Center
Emergency Medical Communication
Trauma System
Communication

Abstracts for articles generated through these searches were reviewed. Relevant articles were obtained and reviewed in full. Following the review of the full documents, only articles deemed relevant to this project are included in this summary. In October and November 2015, as research was conducted with specific emergency communication centers, additional articles and resources were identified. These were reviewed and relevant articles and documents are included in this summary.

**Summary of Findings**

Very few peer-reviewed journal articles focusing on regional or statewide medical communication centers in the United States were identified during this literature review. Newspaper articles and trade journal articles discussed or referenced the development and operations of such centers, and their success in various regions and states. Numerous articles focusing on the development and implementation of regional and/or statewide trauma systems were found, although many of these articles were published in the early-mid 2000s and do not address communication centers established to support regional or statewide trauma systems. Relevant published literature generally fell into four categories:

5 Regional and State Trauma Systems
6 Communication Technologies and Emergency Medical Services (EMS)
7 Telemedicine and Emergency Medical Services (EMS)
8 Pediatric Emergency Medical Services (EMS)

***Regional and State Trauma Systems***
The impact of the development and implementation of regional and/or state trauma systems was the focus of significant research during the 1990s and 2000s. Researchers examined the impact of coordinated trauma systems on patient mortality, hospital length of stay, and cost of care. Findings generally suggest that trauma systems lower patient mortality rates, reduce lengths of stay, and reduce costs of care. One more recent article that focuses specifically on a statewide trauma communication center (Arkansas) found it to be "effective in expediting the transfer process and thus reducing the time to definitive care for severely injured patients" (Porter et al, 2014).

Abernathy, J.H., McGwin, G., Acker, J.E., & Rue, L.W. (2002). Impact of a Voluntary Trauma System on Mortality, Length of Stay, and Cost at a Level I Trauma Center. *The American Surgeon.* 68(2):182-192.

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***Communication Technologies and Emergency Medical Services (EMS)***

Journal articles, many of which examine communications technologies and systems used in Emergency Medical Services in Europe, focus on the evaluation of specific technologies and/or

communications systems and protocols that facilitate the provision of emergency medical services during transport to hospitals. Below are the articles that are relevant to this project and that may provide background information or context for the development and implementation of emergency medical communication centers.

Barthell, E.N., Foldy, S.L., Pemble, K.R., et al. (2003). Assuring community emergency care capacity with collaborative Internet tools: the Milwaukee experience. *Journal of Public Health Management Practice,* 9:35–42.

Bergrath, S., Czaplik, M., Rossaint, R., Hirsch, F., Beckers, S.K., Valentin, B., Wielpütz, D., Schneiders, M. & Brokmann, J.C. (2013). Implementation phase of a multicentre prehospital telemedicine system to support paramedics: feasibility and possible limitations. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 21:54.

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***Telemedicine and Emergency Medical Services (EMS)***

The use of telemedicine has increased across the world during the past few decades. However, very few studies examine the use of telemedicine in ambulances during emergency transport. Those that do tend to focus on the evaluation of specific activities or medical procedures conducted in ambulances with telemedicine tools or remote guidance provided by medical staff at a partner hospital or communication center. The articles listed below address the use of telemedicine in EMS.

Amadi-Obi, A., Gilligan, P., Owens, N., & O'Donnell, C. (2014). Telemedicine in pre-hospital care: a review of telemedicine applications in the pre-hospital environment. *International Journal of Emergency Medicine* 2014, 7:29.

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***Pediatric Emergency Medical Services (EMS)***

An area of interest within the EMS field is pediatric emergency medical services. The relevant article referenced below focuses on the application of new and innovative telemedicine technologies and communication tools to better address the unique needs of pediatric EMS patients. The article listed below may inform the report regarding emergency medical communication centers and pediatric emergency medical services.

Gross, T., Marcin, J., Auerback, M., Middlebrooks, L., Putzier, P.M., Jaeger, M.W., & Abramo, T. (2014). New Technologies in Emergency Medical Services for Children. *Clinical Emergency Pediatric Medicine.* 15(1), 67–78.

# Attachment B State EMS Agency Listing

**Alabama**
334-206-5383
http://www.adph.org/ems/Default.asp?id=801

**Alaska**
907-465-3027
http://www.ems.alaska.gov

**American Samoa**
011-684-633-5003
http://www.americansamoa.gov/index.php/2012-05-02-21-42-40/departments/public-health

**Arizona**
602-364-3150
www.azdhs.gov/bems

**Arkansas**
501-661-2262
www.healthyarkansas.com/ems

**California**
916-322-4336
www.emsa.ca.gov

**Colorado**
303-692-2980
www.coems.info

**Connecticut**
860-509-8000
http://www.ct.gov/dph/cwp/view.asp?a=3127&q=387362

**Delaware**
302-223-1350
www.dhss.delaware.gov/dph/ems/ems.html

**District of Columbia**
202-671-4222
http://doh.dc.gov/service/emergency-medical-services

**Florida**
850-245-4440
www.fl-ems.com

**Georgia**
404-679-0547
www.ems.ga.gov

**Guam**
671-735-7303
http://dphss.guam.gov/content/emergency-medical-services

**Hawaii**
808-733-9210
http://health.hawaii.gov/ems/

**Idaho**
208-334-4000
www.IdahoEMS.org

**Illinois**
217-785-2080
www.idph.state.il.us/ems

**Indiana**
317-234-6804
http://www.in.gov/dhs/3525.htm

**Iowa**
1-800-728-3367
www.idph.state.ia.us/ems

**Kansas**
785-296-7296
www.ksbems.org

**Kentucky**
1-866-97KBEMS
http://kbems.kctcs.edu/

**Louisiana**
225-925-7200
www.ems.dhh.louisiana.gov

**Maine**
207-626-3860
www.maine.gov/ems

**Maryland**
410-706-5074
www.miemss.org

**Massachusetts**
617-753-7300
www.mass.gov/dph/oems

**Michigan**
517-241-3024
www.michigan.gov/ems

**Minnesota**
651-201-2800
www.emsrb.state.mn.us

**Mississippi**
601-576-7400
www.ems.ms.gov

**Missouri**
573-751-6356
http://health.mo.gov/safety/ems/index.php

**Montana**
406-444-3895
http://MontanaEMS.mt.gov

**Nebraska**
402-471-2158
http://dhhs.ne.gov/publichealth/nebraskaems/pages/home.aspx

**Nevada**
775-687-7590
http://dpbh.nv.gov/Reg/EMS/EMS-home/

**New Hampshire**
603-223-4200
http://www.nh.gov/safety/divisions/fstems/ems/index.html

**New Jersey**
609-633-7777
www.state.nj.us/health/ems

**New Mexico**
505-476-8200
www.nmems.org

**New York**
518-402-0996
www.health.state.ny.us/nysdoh/ems/main.htm

**North Carolina**
919-855-3935
www.ncems.org

**North Dakota**
701-328-2388
www.ndhealth.gov/EMS/

**Northern Mariana Islands**
670-664-9135
www.dps.gov.mp

**Ohio**
614-466-9447
http://www.ems.ohio.gov/

**Oklahoma**
405-271-4027
www.ok.gov/health/Protective_Health/Emergency_Medical_Services/

**Oregon**
971-673-0520
www.dhs.state.or.us/publichealth/ems

**Pennsylvania**
717-787-8740
http://www.portal.state.pa.us/portal/server.pt/community/emergency_medical_services/14138

**Puerto Rico**
787-754-2550
no Web site provided

**Rhode Island**
401-222-2401
http://www.health.ri.gov/programs/emergencymedicalservices

**South Carolina**
803-545-4204
www.scdhec.net/health/ems/

**South Dakota**
605-773-4031
http://dps.sd.gov/emergency_services/emergency_medical_services/

**Tennessee**
615-741-2584
www.health.state.tn.us/EMS/

**Texas**
512-834-6700
www.dshs.state.tx.us/emstraumasystems/default.shtm

**Utah**
801-538-6435
www.health.utah.gov/ems/

**Vermont**
802-863-7310
www.healthvermont.gov/hc/ems/ems_index.aspx

**Virgin Islands**
340-776-8311
http://healthvi.org/index.html

**Virginia**
804-888-9100
www.vdh.virginia.gov/oems/

**Washington**
360-236-2830
www.doh.wa.gov/hsqa/emstrauma/

**West Virginia**
304-558-3956
www.wvoems.org

**Wisconsin**
608-266-1568
www.dhfs.wisconsin.gov/ems

**Wyoming**
307-777-7955
http://www.health.wyo.gov/sho/ems/index.html