

# **I**MPLEMENTING



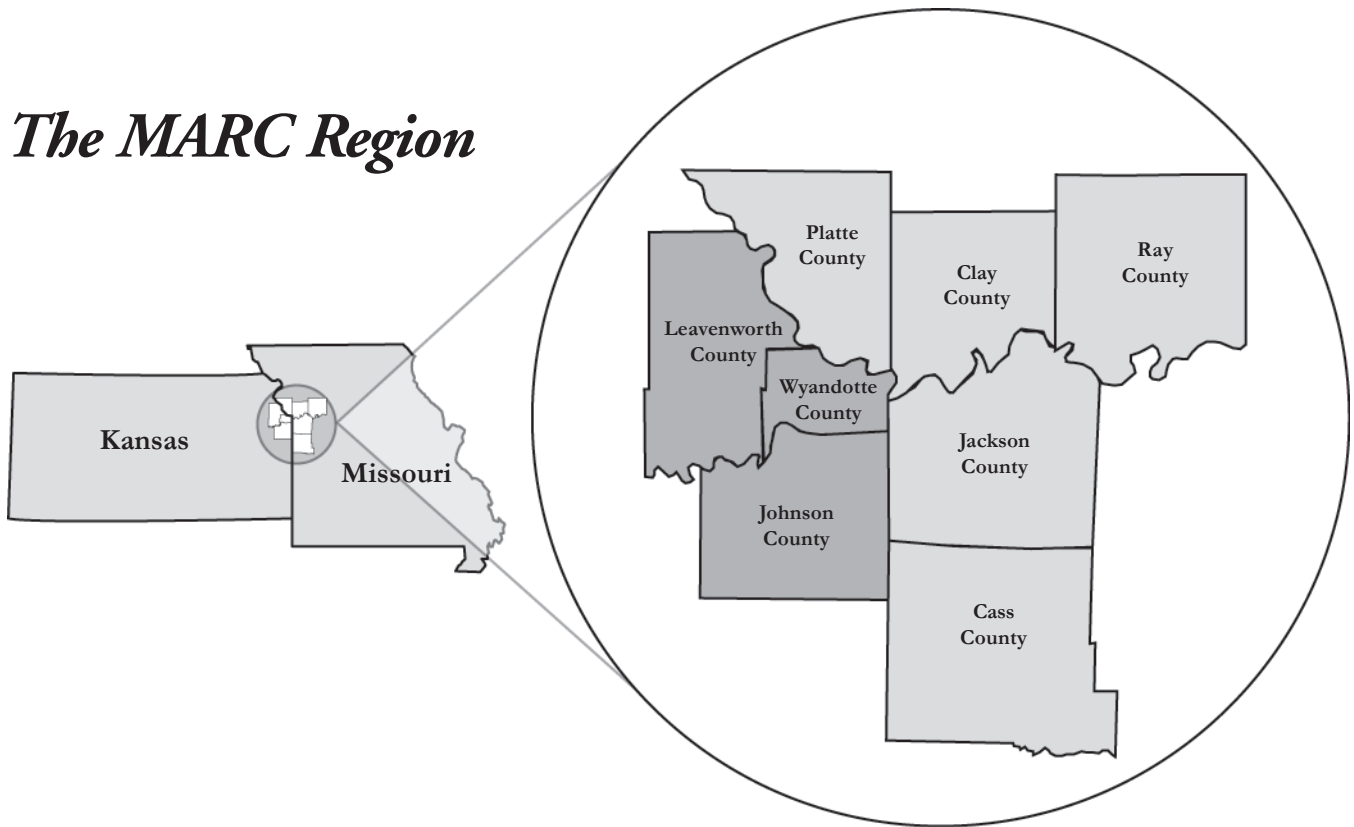
## **PHASE I & PHASE II WIRELESS**

*in the Greater  
Kansas City Region*



*Mid-America Regional Council  
Public Safety & Emergency Services*

# *The MARC Region*



## *Greater Kansas City Regional 9-1-1 System Public Safety Answering Points*

AMR/Medevac Ambulance  
 Belton, Mo., Police Department  
 Blue Springs, Mo., Police Department  
 Cass County, Mo., Sheriff's Office  
 Clay County, Mo., Sheriff's Office  
 Claycomo, Mo., Police Department  
 Excelsior Springs, Mo., Police Department  
 Ft. Leavenworth, Kan., Provost Marshal  
 Gladstone, Mo., Public Safety  
 Grandview, Mo., Police Department  
 Harrisonville, Mo., Police Department  
 Independence, Mo., Police Department  
 Independence, Mo., Backup  
 Jackson County, Mo., Sheriff's Office  
 Johnson County, Kan., Emergency  
     Communications Center  
 Johnson County, Kan., Sheriff's Office  
 Johnson County, Kan., Backup  
 Kansas City, Mo., Fire Department  
 Kansas City, Mo., Police Department  
 Kansas City, Mo., Backup  
 Leavenworth County, Kan., Sheriff's Office  
 Leavenworth, Kan., Police Department  
 Leawood, Kan., Police Department

Lee's Summit, Mo., Fire Department  
 Lee's Summit, Mo., Police Department  
 Lenexa, Kan., Police Department  
 Liberty, Mo., Police Department  
 MAST (Metropolitan Ambulance Services Trust)  
 MAST Backup  
 Mid-America Regional Council  
 North Kansas City, Mo., Police Department  
 Olathe, Kan., Police Department  
 Overland Park, Kan., Police Department  
 Platte County, Mo., Sheriff's Office  
 Pleasant Hill, Mo., Police Department  
 Pleasant Valley, Mo., Police Department  
 Prairie Village, Kan., Police Department  
 Ray County, Mo., 9-1-1  
 Raymore, Mo., Police Department  
 Raytown, Mo., Police Department  
 Riverside, Mo., Dept of Public Safety  
 Shawnee, Kan., Police Department  
 Sugar Creek, Mo., Police Department  
 Unified Government of Kansas City, Kan./  
     Wyandotte County  
 Kansas City, Kan., Backup

# I NTRODUCTION

---

---

## *The Mid-America Regional Council*

The Mid-America Regional Council, commonly referred to as MARC, serves as the association of city and county governments and the metropolitan planning organization for the bistate Kansas City region. MARC seeks to build a stronger regional community through cooperation, leadership and planning. Through MARC's leadership, area jurisdictions and diverse community interests come together to address the region's problems and identify the opportunities for cooperative solutions. These efforts, in turn, enhance the effectiveness of local government.

As a voluntary association, MARC strives to foster better understanding and cooperation on issues that extend beyond the jurisdiction of a single city, county or state. These issues include transportation, child care, aging, emergency services, environmental issues and a host of others. MARC's Board of

Directors consists of 30 locally elected leaders representing the eight counties and 114 cities in the bistate metropolitan Kansas City region.

## *The Regional 9-1-1 System*

MARC serves as the coordinating agency for the Greater Kansas City Regional 9-1-1 System, which consists of 45 public safety answering points (PSAPs) and nearly 600 dispatchers. Together, these PSAPs handle over 2 million emergency calls annually. The regional 9-1-1 system is governed by the 9-1-1 Policy Board, which consists of agency administrators and elected officials from local governments. This committee was established by the 9-1-1 Interlocal Cooperation Agreement, and has broad powers in activities such as monitoring and revising policies to ensure the effective operation of the regional 9-1-1 system.



### *The Mission of the Regional 9-1-1 System:*

*“To establish and maintain 9-1-1 as the primary emergency telephone number for the Kansas City metropolitan area and enhance the ability of local governments and emergency service providers to respond to calls for emergency assistance.”*

# *A Need for* ACTION

Industry experts indicate that there were 109 million wireless subscribers in the United States in 2001. In 2002, the number of wireless subscribers in the United States grew to more than 141 million. Concurrently, wireless minutes used were up 36 percent from 2001 to 2002 and are continuing to increase.

*In 2002, the number of wireless subscribers in the United States grew to more than 141 million.*

Wireless telephone service has grown beyond subsidiary, as wireless telephone companies are beginning to compete with wireline exchange service providers for basic telephone service.

As the growth in wireless communication began to manifest itself early in the 1990s, the Federal Communications Commission (FCC) issued a ruling for wireless 9-1-1 in 1994, requiring that emergency service providers and wireless service providers implement wireless 9-1-1 according to a timeline based on current technology.

Under the leadership of its 9-1-1 Policy Board, The MARC region began mapping a plan to meet the deadlines established by the FCC.

Regions throughout the country share the challenges of upgrading their emergency response systems to enable wireless Phase I and Phase II implementation. However, at several major points, MARC chose to break new ground to overcome typical challenges with innovative solutions.

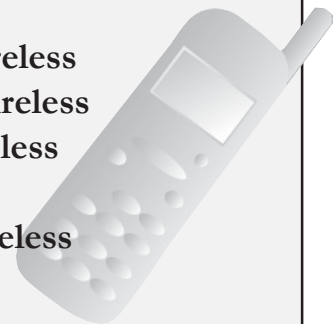
## *Challenge: Equipment Upgrades*

The FCC's original ruling required both the government agency and the wireless service provider to be ready to implement wireless 9-1-1 according to its timeline. Therefore, new 9-1-1 answering equipment was needed across the region to accommodate wireless Phase I and Phase II information.

A later ruling in the Richardson case held that a Phase I or Phase II data request to a wireless service provider from an agency or PSAP is valid as long as the PSAP has ordered the equipment necessary to receive and utilize the E911 data, and this equipment will be installed and capable of receiving and utilizing that data no later than six months following its request.

### *Wireless Service Providers in the Greater Kansas City Region*

- AT & T Wireless
- Cingular Wireless
- Nextel Wireless
- Sprint PCS
- Verizon Wireless
- T-Mobile



To expedite the region's readiness to receive Phase I and Phase II data, the MARC region made a conscious policy decision NOT to implement Phase I and Phase II wireless incrementally. Rather, the region chose to upgrade immediately to Phase II-ready equipment. To purchase this equipment, a Request-for-Proposal process was initiated, which included a system conference and questionnaire method. The RFP document draft was posted on the MARC web site for comment prior to the final document being released for bid.

***The MARC region made a conscious policy decision NOT to implement Phase I and Phase II wireless incrementally. Rather, the region chose to upgrade immediately to Phase II-ready equipment.***

After the RFP was finalized and distributed, an evaluation process was designed that included presentations by the top two proposers. After an extensive review of the proposals by a technical subcommittee, CML Emergency Services, Inc. was chosen as the vendor for the regional 9-1-1 equipment upgrade.

An agreement to purchase CML equipment was signed in mid-2001. One noteworthy requirement of the RFP was that the installation include a pilot project that would launch the system into two area PSAPs and run for at least a month. The Kansas City, Missouri, Police Department and the Johnson County, Kansas, Sheriff's Department were chosen as the pilot sites for a variety of reasons including location, size and call volume.

The MARC region also faced the challenge of transitioning from a central office-based Automatic

Call Distributor (ACD) system to a controller-based ACD at the largest PSAPs. In some cases, an agency's backup site is also used as an overflow answering point, so the network was redesigned to transition successfully.

Phase II-compatible equipment was installed throughout the region by mid-2002 on a very aggressive schedule. MARC contracted with Commenco, a wireless communications provider based in the Kansas City area, to perform the installation regionwide. An average of two PSAPs were transitioned to the new equipment each week. Prior to each PSAP installation, a meeting was held with the PSAP manager, MARC personnel and the vendor to arrange scheduling and training, and to discuss network issues and other concerns. MARC staff was "on-site" for each cutover, and a final system acceptance checklist was completed by MARC and the PSAP manager approximately two weeks after installation.

In response to training needs, the Regional 9-1-1 Training Program (also administered by MARC) initiated an intensive equipment training program for all dispatchers in the region, which continues today. Dispatchers can receive training on the new equipment at no charge to their agencies.

***MARC contracted with a wireless communications provider based in the Kansas City area to perform the installation region-wide. An average of two PSAPs were transitioned to the new equipment each week.***

After the installation of the equipment was scheduled, the MARC region was able to issue requests for Phase I and Phase II wireless information from the six major wireless service providers in accordance with the FCC's Richardson Order. These six service providers collectively operate more than 2800 wireless sectors in the Greater Kansas City region.

# COORDINATING

## *Project Elements*

---

### *Challenge:* *Engaging Wireless Service Providers*

Initially, the FCC's ruling stated that government agencies that administer 9-1-1 systems would pay the service providers' costs for implementation. However, the FCC later amended its ruling, stating that agencies are only responsible for their own costs in upgrading to Phase I and Phase II wireless 9-1-1. Wireless service providers must pay their own costs associated with the provision of enhanced.

In a related FCC ruling, the King County decision determined that the selective router is the line of demarcation: Getting information to the selective router is the responsibility of the wireless service provider; the 9-1-1 agency is responsible for the cost of carrying information from the router to the PSAP.

### **9-1-1** *Resolution*

There was a concerted effort to provide consistent, uniform guidelines to the six wireless service providers operating in the region. Rather than contracting with each individual wireless service provider, MARC drafted **Wireless Policies**, governing the integration of wireless 9-1-1 service with existing infrastructure in the MARC 9-1-1 region. Since a contract was not executed with any of the wireless service providers, these policies defined the "SOPs" for MARC and the wireless service providers operating in the region.

These **Wireless Policies** were adopted by the 9-1-1 Policy Board responsible for overseeing the regional 9-1-1 system. To further support the wireless service providers in this venture, MARC prepared **Wireless PSAP Data Books**. These books contained the information that wireless service providers would need to work with the 9-1-1 agencies: PSAP locations, the communities each serves, default numbers and agency contact persons for technical, administration and operational issues.

MARC released several other publications to support the PSAPs as wireless implementation continued in the region:

- **Guidelines for Minimum Response to Wireless 9-1-1 calls**  
This guideline established recommended operating procedures for PSAPs participating in the regional 9-1-1 system. This guideline was established and administered by the 9-1-1 Policy Board.
- **Wireless Testing Guidelines**  
In preparation for wireless deployment, MARC prepared guidelines for use by wireless service providers for Phase I and II testing.
- **PSAP Wireless Training Handbook**  
A comprehensive guide to the stages of implementation in the region, targeted toward the call-taker. The handbook included an overview of enhanced wireless 9-1-1 policies and procedures, frequently asked questions, a glossary and definitions of technical terms. The handbook has been certified by the State of Missouri for telecommunicator training hours.

These guidelines facilitated the implementation process. However, there was no mechanism for cost recovery for the wireless service providers, and

therefore little incentive for them to proceed quickly with implementation.

As identified in an FCC investigation, "PSAP fatigue" was becoming a phenomenon across the country. Many agencies report that claims that agencies are not ready to receive Phase I and Phase II data has been one way for the wireless service providers to postpone their own readiness without risking noncompliance with the FCC. During the implementation process, MARC was repeatedly asked to prove its readiness to receive this data.

***MARC repeatedly proved its readiness to receive Phase I and Phase II information.***

Throughout this period, MARC has maintained its position and reinforced the message to the service providers of their obligation to follow FCC mandates. MARC repeatedly proved its readiness to receive Phase I and Phase II information.

## ***Challenge: Mapping the Region***

Interwoven with the equipment upgrade was the installation of GIS mapping software to provide location information to the dispatchers. It became obvious that an X,Y coordinate, such as that provided by wireless service providers' Phase II equipment, would not be adequate to dispatch responders to an emergency. A digital map of the region was required to give the coordinates meaning.

**9-1-1**

## ***Resolution***

The request for proposals for 9-1-1 equipment included the requirement for a software package that would read the X,Y coordinate, plot it onto a map, and automatically display the location of the wireless call.

At the outset, the region did not have precise map data. After extensive analysis of available data, MARC chose to purchase ownership rights of a highly accurate and comprehensive map from a private vendor. To maintain this map, the cities and counties in the region agreed to provide geographical updates to MARC as they occur. After another RFP process, MARC selected GeoComm, a private 9-1-1 mapping and communications vendor, to maintain, host and update the regional map data. Map updates are made available to all PSAPs in the region via a secure, high-speed Internet connection coupled with software at the PSAP that automatically downloads the latest version of the map data on a seven-day cycle.

Other entities also provide integral information to keep the regional map current. To maintain wireless call routing, the wireless service providers (or their third party vendors) provide call routing maps to MARC for the approximately 2800 cell tower sectors in the region. These maps include cell tower locations and the coverage areas of the different sectors for that tower. This information is updated continuously as coverage areas evolve and new towers are built.

***Map updates are made available to all PSAPs in the region via a secure Internet connection, coupled with software that automatically downloads the latest map data.***

Further, the PSAPs are responsible to provide their boundary verification to MARC. This must be updated according to annexations and other geographical developments that might modify which PSAP would respond to a 9-1-1 caller in a given geographical area.

It was a great cooperative effort to bring the eight counties in the region together to update this map. Today, this map is available for use by all local governments and other not-for-profit entities in the region. The **MARC E9-1-1 Mapping Policies** govern its use, which have become part of the Interlocal Operating Agreement.

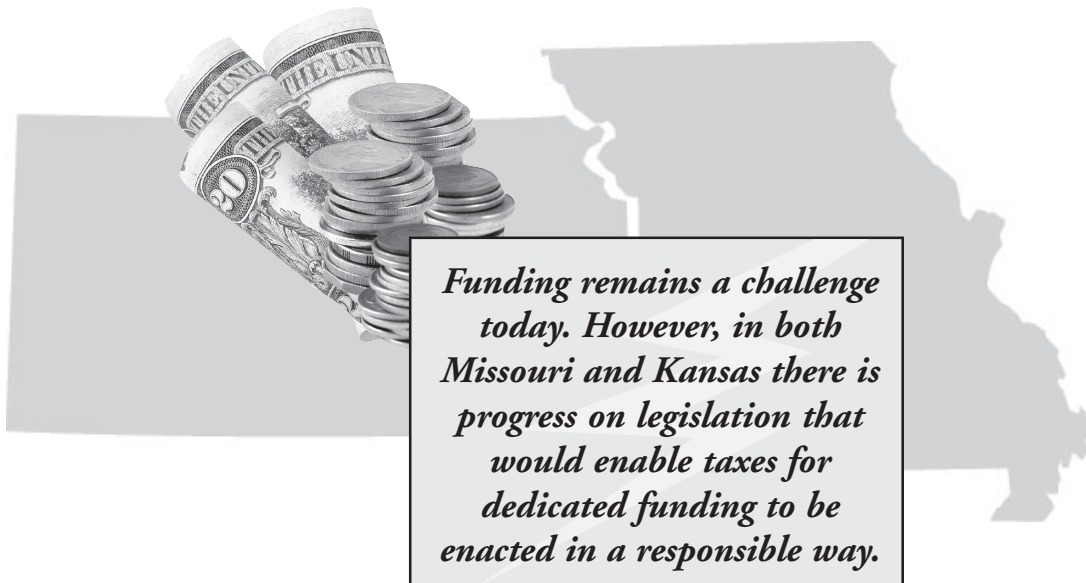
## ***Challenge: Funding the System***

Dedicated funding for the implementation of wireless 9-1-1 has been an ongoing challenge. Kansas and Missouri are non-cost-recovery states, meaning that there is not a dedicated funding source specifically for enhanced wireless 9-1-1. Currently, efforts are underway in both states to create a mechanism to put a surcharge on wireless phones. This measure will require legislative approval (in Kansas), and voter approval (in Missouri).

9-1-1

## ***Resolution***

Despite the lack of dedicated funding for wireless implementation, the 9-1-1 Policy Board had the foresight to forge ahead with implementation. Funding remains a challenge today. However, in both states there is progress on legislation that would enable these taxes to be enacted in a responsible way.



***Funding remains a challenge today. However, in both Missouri and Kansas there is progress on legislation that would enable taxes for dedicated funding to be enacted in a responsible way.***

# *Selective Routing*

# INNOVATION

## *Challenge:* *Local Exchange Carrier Tariffs*

The tariffs that the Local Exchange Carrier (LEC) would charge to route 9-1-1 calls through their selective router were a most significant barrier to implementation. The LEC had an existing tariff that would cost the 9-1-1 system \$36 per month, per pANI (a non-dialable routing number which identifies the cell sector from which the call originated) for each of the approximately 2800 cell tower sectors in the region. Moreover, the LEC was not willing to commit to a timeline to establish its readiness to receive wireless call data — resulting in

a delay in the ability of the region to proceed with Phase I and Phase II implementation.

9-1-1

## *Resolution*

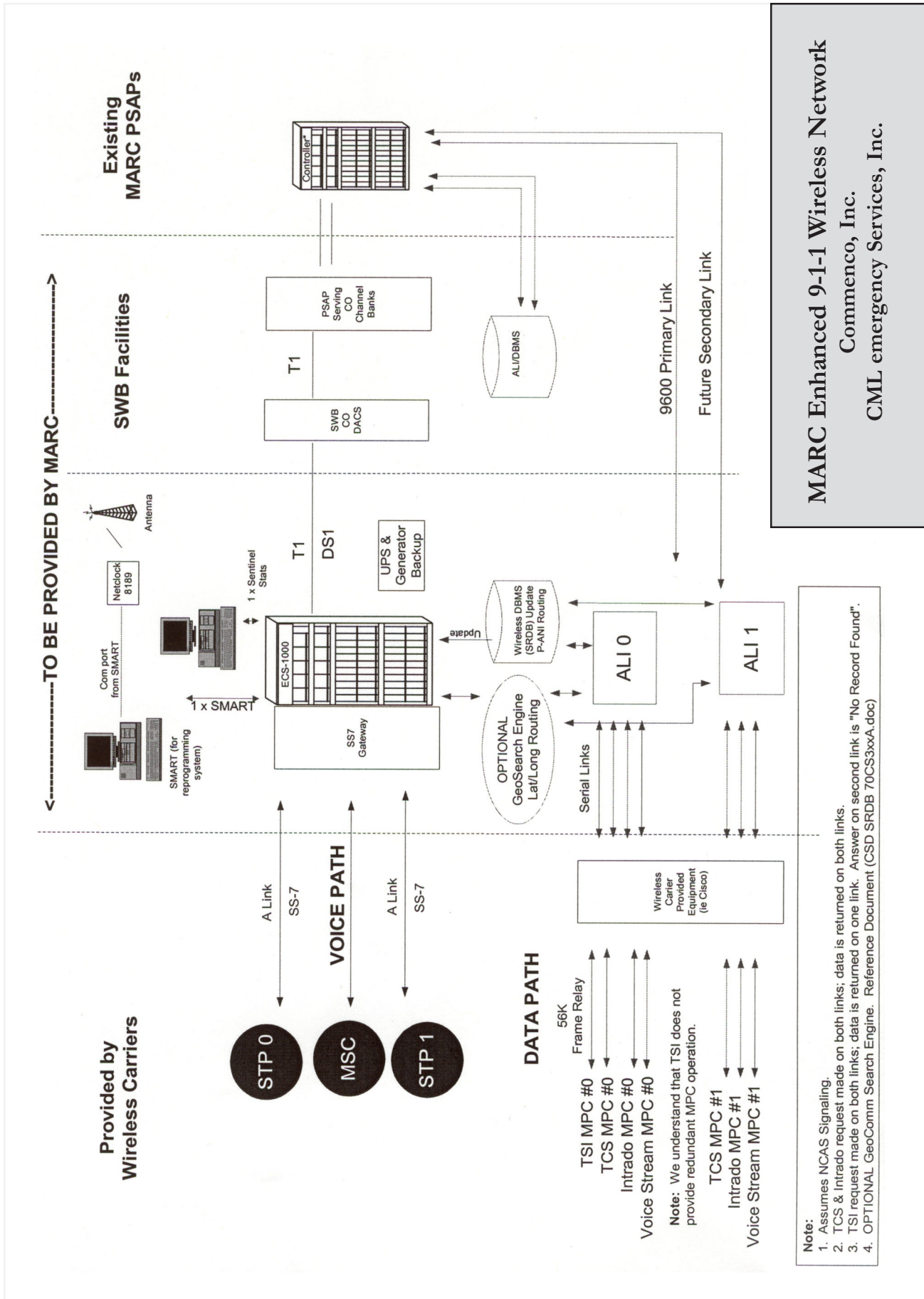
It became clear that the timely implementation of wireless 9-1-1 was in jeopardy due to circumstances beyond the control of the regional 9-1-1 system leadership. This led to the groundbreaking decision to purchase a selective router to route wireless 9-1-1 calls. This router is owned by MARC and is independent of the LEC.

This is truly a pioneering move in emergency communications management, since it eliminates the use of the LEC's selective router and database for wireless calls. (Wireline calls still run through the LEC's selective router.) The savings in the first year alone will cover the cost of the equipment.

MARC's selective router essentially sets up two separate systems to route wireline and wireless calls, with no single point of failure. Moreover, this separate routing system reduces the possibility of overloading all 9-1-1 trunks due to highway accidents or other situations that have traditionally led to extraordinary spikes in volume on the 9-1-1 system.

Another benefit of MARC's wireless selective routing and SS7 capability is much improved statistical information on 9-1-1 call processing. This data will keep MARC informed on critical issues such as 9-1-1 call blocking in the network due to insufficient capacity. It will also allow MARC to know if any part of the network is over-configured, i.e. served by (and paying for) more trunks than are required.





**Note:**

1. Assumes NCAS Signaling.
2. TCS & Intrado request made on both links; data is returned on both links.
3. TSI request made on both links; data is returned on one link. Answer on second link is "No Record Found".
4. OPTIONAL GeoComm Search Engine. Reference Document (CSD SRDB 70CS3xxA.doc)

## *Challenge:*

### *Router Site Selection*

There were many issues to consider in determining the site for the selective router. Security was undoubtedly the primary concern. It was also vital that the location offer a reliable backup power source in case of a service interruption. It was important that the router be within close proximity to the LEC central office.

9-1-1

### *Resolution*

Today, the selective router is housed in an undisclosed location in the region that offers a high level of assurance in these and other areas of concern.

## *Challenge:*

### *Local Exchange Carrier Tariffs, Part II*

The LEC still maintains selective routing for wireline calls, but for wireless calls it only provides the 9-1-1 trunks and circuits from the new MARC selective router to the PSAPs. A total of 160 wireless trunks and ALI circuits were installed to handle the anticipated call volume. These trunks are monitored closely and reconfigured as needed. These new trunks are a source of new revenue for the LEC. Despite this, the LEC announced that, in their view, the applicable tariff rates were private business rates, rather than the 9-1-1 tariff rates. As a result of these practices, the cost to the 9-1-1 system is exorbitant and is being challenged.

9-1-1

### *Resolution*

Despite this unanticipated expense, MARC and the local governments in the region decided to forge ahead rather than derail the project. The LEC was

notified that the project would proceed under protest and would not be stalled by this issue.

As part of this protest, MARC reserved the right to seek recovery of the overcharges once this cost issue is resolved.

## *Challenge:*

### *SS7 Connectivity*

While the voice portion of wireless calls are transmitted via T1 telephone circuits, the most efficient means of sending the data that accompanies the calls from the wireless provider's switch to the MARC selective router is via the Signaling System 7 (SS7) network.

Although this is not new technology, historically SS7 has only been used by wireless service providers and local exchange service providers. There was no precedent to provide access to this network to local governments or other entities.

Connectivity providers were reluctant to embrace this new approach, and initial attempts to gain access to this network were met with skepticism. Most providers did not look beyond charging commercial use rates, which made the service prohibitive.

9-1-1

### *Resolution*

Telecommunications Services Incorporated (TSI), a progressive provider of SS7 connectivity for LECs and wireless service providers, understood the lifesaving potential of this project and entered into a contract to provide SS7 connectivity for a flat monthly rate.

Under this contract, any charges associated with the traffic through that system are sent back to the wireless service provider or absorbed by TSI. In addition to this monthly fee, there was an application fee for a "point code" to gain access to this network.

## ***Challenge:*** ***SS7 Redundancy***

Minimization of the possibility of system failure requires avoidance of a single point of failure. Therefore, the connection to the SS7 network must be redundant.

### **9-1-1** ***Resolution***

TSI provided two separate entry points to their network via separately-routed circuits called A-links. Separate SS7 gateways were installed for each of these circuits and the assignment of TIs from each wireless carrier was divided between the two gateways. The wireless carriers were encouraged to diversify their calls between the two groups of circuits.

Under typical circumstances, an equipment or circuit failure could result in the dropping of calls in process. This system was designed to react to the failure and

avoid the loss of 9-1-1 calls. The TSI equipment detects the failure of either an A-Link circuit or the gateway connected to the circuit and immediately reroutes all 9-1-1 call data down the other circuit. No subsequent 9-1-1 calls are lost.

If both gateways are working, all TIs into the selective router are used to deliver 9-1-1 calls. If one of the gateways fails, the remaining gateway handles all of the calls.

A total failure of the voice or A-Link circuits to the selective router, the SS7 gateways or the selective router results in wireless carriers sending their 9-1-1 calls to predetermined administrative lines for the appropriate PSAP based on the tower sector location.

***MARC's purchase of its own selective router, independent of the LEC, is truly a pioneering move in emergency communications management.***

# IMPLEMENTING *the System*

---

## ***Challenge:*** ***Managing Wireless Emergency Numbers***

Emergency Service Numbers (ESNs) for wireline calls are determined by emergency responders for geographic areas. However, wireless ESNs are different, in that an ESN is assigned for PSAP routing rather than emergency responder. Consequently, a PSAP may have multiple ESNs for wireline calls, but only one ESN for wireless calls routed to that PSAP. Wireless ESNs will primarily be used as a default if the region begins routing Phase II 9-1-1 calls by X,Y coordinate.

### **9-1-1** ***Resolution***

MARC created a series of ESNs for use within the wireless 9-1-1 system. In the past, the LEC had issued wireless ESNs. For those already in place, those numbers were maintained and new numbers were assigned where needed.

## ***Challenge:*** ***Managing Routing Numbers***

The pANI/ESRK identifies the particular cell tower sector from which a wireless call originates (and the applicable ESN), while ranges of pANIs/ESRKs are assigned to particular ESNs and may be utilized by

any cell tower sector to indicate the correct ESNs and pANIs/ESRKs. These numbers must be unique for each carrier and maintained in a database to provide the selective router with the information necessary to route incoming 9-1-1 calls.

### **9-1-1** ***Resolution***

The functions of selective routing of calls and managing the database have traditionally been managed by the phone company. In this model, MARC developed and maintains this routing database. Wireless service providers have the option to receive numbers issued by MARC, or create their own.

By administering the pANIs the region avoids the charge proposed by the LEC for numbers in its database. If service providers choose to use their own block of pANIs, these must be provided to MARC.

## ***Challenge:*** ***Wireless Database Management***

Wireless service providers typically utilize third-party providers to maintain their databases. Part of the wireless 9-1-1 call process is a query for the X,Y coordinate, which is sent to these database providers who in turn provide the coordinates. This required multiple connections at each PSAP, each with the ability to distinguish which provider's database to query, based on the information received with the call.

MARC installed an ALI database server located with the selective router. The database is connected to each of the third-party database providers. Each PSAP is connected to this server via modem circuits, and this server routes the queries to and from the PSAPs and the appropriate third party database.

In order for the location information to route to the proper place from the wireless databases, MARC installed a Cisco data router for each third-party database provider adjacent to the database and selective router. This allowed for the location information to travel back to the PSAP processing the call.

## *Challenge: Testing the System*

Once the elements were implemented, extensive testing was required before the region could cut over to the new system. This testing had to be completed on an aggressive schedule, yet be carefully planned to eliminate any possibility of interrupting the flow of calls into the PSAPs. Moreover, PSAP management and dispatchers had to be continuously informed of testing schedules and developments during implementation.

**Wireless Testing Guidelines** were designed by MARC staff for use by wireless service providers during Phase I and II testing. MARC staff worked to design these guidelines well in advance of any actual testing. MARC also worked closely with the wireless service providers during the testing phase to schedule testing with PSAPs and ensure that there was no disruption to the answering point.

## *Challenge: User Education*

As the region grew closer to implementation, it became clear that PSAP personnel needed training on procedures during the testing phase.

MARC staff developed a **PSAP Wireless Training Handbook**, a comprehensive guide to the stages of implementation in the region. Targeted toward the dispatcher, the handbook included an overview of the project, enhanced wireless Phase I and II policies and procedures, frequently asked questions, a glossary and definitions of technical terms.

The handbook has been certified by the State of Missouri for telecommunicator training hours. This guide was distributed to all PSAPs in the region prior to the beginning of the testing phase.

User education will be ongoing. As the system evolves, the MARC 9-1-1 Training Program will be constantly updating its curriculum to offer technical training on handling wireless calls.





**600 Broadway, Suite 300  
Kansas City, Missouri 64105-1554  
Phone 816/474-4240 • Fax 816/421-7758  
[www.marc.org](http://www.marc.org)**