

NENA Wireless Checklist and Modules Operational Information Document (OID)



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1. Executive Overview

The Wireless E-911 deployment process requires a large amount of coordination and collaboration to be successful. Expectations need to be set and managed throughout the deployment process to prevent misunderstandings and unnecessary delays. A systematic approach to deployment as laid out in this document will help avoid problems and speed deployment since all stakeholders will know their roles. This document covers the following steps of the deployment process:

- Deciding whether or when to proceed with Phase I or Phase II deployment
- The initial contact with the 9-1-1 service provider
- Proper notifications that need to be made
- Organizing the initial planning meeting
- Completing the call routing data sheets and addressing database issues
- Establishing an ALI delivery standard
- Establishing a GIS system
- Testing the initial deployment of the system
- Post deployment issues

2. Introduction

2.1. Purpose and Scope of Document

This document is intended to act as a best practice for the deployment of wireless E-911 Phase I and Phase II. As such, its primary goal is to set expectations and improve communications among the many parties involved in the deployment process. Many early deployments were delayed by the lack of an understood process. The lines of communications are extremely important during the deployment of Phase I and II service.

This document cannot outline all possible or acceptable steps in the deployment of wireless service. Some variation may be acceptable or appropriate given any particular situation. The goal is to recognize that it is a variation from the accepted best practice and that it needs to be communicated to and agreed to by all parties. Without this best practice, it is impossible to distinguish what is best practice and what is variation. It should not be assumed that a deviation from this document is not “the best” practice in all cases. Some location solutions may be “the best” for a particular situation.

This document is also not intended to replace other existing best practice documents from NENA and other organizations. The intent is to support and expand on those other documents.

2.2. Reason to Implement

All stakeholders involved in the wireless E-911 deployment process should consider using this OID to help avoid miscommunications during the deployment process. Only when all parties start from the same “sheet of music” can the parties remain together as the challenges of deployment are encountered. Even if the checklist is not followed verbatim, this OID can be used as a starting point for discussions to ensure that all issues are addressed.

2.3. Reason for Reissue

NENA reserves the right to modify this document. Whenever it is reissued, the reason(s) will be provided in this paragraph.

2.4. Recommendation for Standards Development Work

The establishment of a standard routing data worksheet and ALI data delivery standard are two additional standards that may be considered for development.

2.5. Cost Factors

Not applicable at this time.

2.6. Acronyms/Abbreviations

All acronyms/abbreviations used in this document have been included in the master glossary. Link to the master glossary is located at http://www.nena.org/9-1-1TechStandards/vena_recommended_standards.htm.

3. Operational Description

3.1. Phase I and II Planning and Implementation Checklist

3.1.1. Overview

Wireless Phase I or Phase II 9-1-1 deployments can be completed with minimal difficulty when standard processes are understood and employed. The following are steps required for each category or module within the deployment flow. By understanding each of the steps required for a successful Phase I deployment and their relative order within the flow of the deployment, efficient planning can be put into practice and unexpected surprises can be avoided. The smoothest deployments occur when strong program management is employed during a Planning and Communications Phase. There are multiple players involved in a wireless deployment and the completion of each task or related sub-module is critical to keeping deployment activities on track. The Project Manager's (PMs) job is to insure that each participant knows what they need to do, why they need to do it, and the schedule for getting it done.

The items in the following sections of the checklist are discussed in greater detail in the module following the checklist.

3.1.2. Planning and Communications

3.1.2.1 Deciding to proceed

- Determine the need to just implement Phase I Wireless 9-1-1 Service or total implementation with Phase II Wireless.
- Organize a team to be responsible for the deployment of the wireless E-911 service in your locality.
- Appoint a project manager from the PSAP to act as the single point of contact for all stakeholders.

3.1.2.2 Initial 9-1-1 Service Provider Contacts

- Schedule a meeting with 9-1-1 service provider marketing and technical representatives to determine their ability to provide wireless 9-1-1 services and their preferred technology.
- With the 9-1-1 service provider and other equipment vendors, determine the impact on all 9-1-1 equipment, current trunk configurations, expansion trunking decisions, ALI display format, mapping, and computer aided dispatch systems.
- Determine what options are available for upgrade or replacement.
- Order the necessary upgrades and obtain a schedule for their implementation.
- Ensure that upgrades can be completed within six-month.
- Request a copy of the PSAP's MSAG for use during the routing phase of deployment.

3.1.2.3 Notifications

- Determine what WSP's are currently providing service in the PSAP service area.
- Send the Wireless Service Providers (WSPs) certified letters, requesting wireless Phase I or Phase II 9-1-1 service. Include with the letters a copy of any upgrade orders and other documentation showing the PSAP is ready. For Phase II requests, the ESIF PSAP Readiness Checklist should also be provided with the letters of request (<http://www.atis.org/atis/ESIF/ESIFdocs.htm>).
- Copy 9-1-1 service provider and the State 9-1-1 Coordinator (if appropriate) on letters to Wireless Service Providers (WSPs).
- Inform all Wireless Service Providers (WSPs) if you have an open document statute or freedom of information act in your state.
- Establish a date for the first planning meeting or a conference call with the Wireless Service Providers (WSPs), the required 9-1-1 service providers, and the Development Implementation Team allowing at least 30 days notice.

- Notify all parties, 9-1-1 service provider, WSP, Implementation team of the desire to have a **MANDATORY** kickoff meeting or conference call.

3.1.2.4 Planning Meeting

- Conduct the meeting or conference call with all of the participants that will be involved in the implementation process.
- Indicate to the WSP's that proprietary issues will not be discussed during this meeting.
- Determine if a service agreement will be necessary between WSP's and the PSAP. If so, the agreement must be acquired, negotiated and signed.
- Determine if interconnect agreements between WSP's and 9-1-1 service provider are signed and in place. If not, inquire as to the expected date of completion and whether the lack of an agreement will impact the deployment schedule.
- Attempt to resolve the critical deployment issues at this meeting (listed in the Planning and Communications module below).

3.1.2.5 Routing Sheet and Associated Database Standard

- Request each Wireless Service Provider produce RF coverage area maps and a routing data sheet for all cell sectors with RF coverage within your PSAP service area.
- Associate individual cells and sectors with individual PSAPs (ESNs) based on the area primarily served by that cell sector. The goal is to identify the cells/sectors in each PSAP service area, in order to establish selective routing assignments.
- Review all data associated with each cell sector to ensure accuracy and consistency between the WSP's.
- Review cell sectors along the jurisdictional borders with the neighboring agency to determine the most appropriate routing. Regional meetings make this process easier.
- Determine default routing of calls.
- Determine alternate routing of calls.

3.1.2.6 ALI Database Delivery Standard

- Obtain a copy of the Phase II ALI data format from the ALI database provider.
- Determine how the ALI fields are to be populated by each Wireless Service Provider (WSP).
- Ensure that the ALI database provider has updated the MSAG to reflect the cell site addresses and that ALI records have been built properly.

- Ensure that the 9-1-1 service provider has assigned an ESRK range to the each wireless ESN or ESRD to each cell sector and that these have been provisioned in the selective routing database properly.
- Ensure that translations are provisioned in the WSP's mobile switching center (MSC).

3.1.2.7 Geographic Information Systems (GIS)

- Determine the method of displaying the Phase II data within the PSAP.
- Determine the source of and acquire the GIS data to be used in the mapping display system.
- Implement the method of displaying the Phase II data within the PSAP.

3.1.2.8 Implementation Testing Standard

- Ensure that the PSAP is ready for testing and deployment.
- Schedule the testing, giving all parties at least five-business days notice.
- Stagger the testing schedules. Do not attempt to activate Phase I or Phase II with all WSPs during the same week.
- Review and approve the WSP's test plan.
- Conduct switch level testing documenting any deficiencies for correction.
- After successful completion of switch level testing, conduct sector level testing leaving cell site "live" after each successful test.
- Ensure that you have received the appropriate documentation of the successful completion of the overall test within 7 days of completion.

3.1.2.9 Post-implementation

- Ensure that all new or re-homed sites are tested in the same manner as the original test.
- Determine method for obtaining new and revised cell information from the WSP's.
- Determine a method of notification for new WSP's entering the area.
- Ensure that the PSAP has emergency contact information for each WSP to include both reporting service trouble and acquiring subscriber information.
- Track call volumes to determine ongoing trunking requirements.
- Obtain usage data from WSP's for MSC to 9-1-1 tandem trunks.
- Obtain usage data from the 9-1-1 service providers for 9-1-1 tandem to PSAP trunks.
- Periodically drive test each WSP's service to ensure it is functioning properly from all sites.

3.2. Planning & Communications

3.2.1. Deciding to proceed

Deciding when and how to proceed with the deployment of wireless E-911 Phase I or Phase II can seem like a daunting task. For many PSAPs there are many questions (such as how much will it cost, how many more calls will the PSAP have to handle, etc.) that will need to be answered before a commitment to the service can be made.

To begin to answer some of these questions and to begin to build support for the deployment, the establishment of a Development Implementation Team may be appropriate. This team should be charged with carefully considering the costs and the benefits of the deployment of service. Members of this team may include representatives from County Sheriff's Office, City Police Department(s), Emergency Medical Services, Fire Departments, Ambulance services (if used in your area) and the Division of Emergency Management.

The team should meet to discuss any statutory requirements of Phase I and Phase II and to review the checklist above. To answer some of the questions, the team may want to talk to other localities that have deployed the service of similar size and demographics. A state E-911 coordinator or the president of the local NENA chapter may be able to assist in identifying similar localities. Additionally, the current recipient of the wireless calls, if not already answered by the PSAP (i.e. the state police or highway patrol), may be able to provide information about the current call load.

The team should determine the political considerations of implementation from fiscal control and legal personnel (county/city attorney) and make the appropriate meeting take place. Many states offer funding or cost recovery for the deployment of wireless E-911. All costs and impacts should be identified before the decision is made to proceed. This will prevent later problems when unidentified costs and impacts will become apparent.

The team should appoint a project manager to act as the single point of contact for all stakeholders at the locality. While this is often the PSAP manager, the team must ensure that the PSAP manager has the time to commit to the project. If not, another project manager (such as a consultant) may be appropriate.

Other issues to consider during the team meeting include the following:

- (1) Evaluate operational issues such as trunking, equipment, staffing, the idiosyncrasies of wireless calls, etc.
- (2) Wireless calls tend to take longer to process than wireline calls, due to the inability of the caller/phone to give an exact location. This may have an impact on staffing requirements if the calls are not already being routed to the PSAP.
- (3) Typically, more calls are received from wireless telephones per incident than from wireline telephones. Review the physical infrastructure in the PSAP to ensure it can handle such peaks.
- (4) There may be a requirement for additional call takers or answering positions at the primary PSAPs. Has this growth and change been anticipated?

- (5) Establish some type of call reporting analysis on current trunk groups to determine P.01 and trunk loading. A review of call data, if available, may help to establish possible trunk and administrative line upgrade requirements.
- (6) Wireless 9-1-1 calls are growing each year as the number of wireless phones continues to increase. Additional trunks may be required from the 9-1-1 tandem switch to the primary PSAPs for the delivery of wireless 9-1-1 calls.
- (7) If dedicated Wireless 9-1-1 trunks are being installed at the PSAP, determine where these lines will overflow so as not to saturate your wireline trunks. It is not recommended that the wireless trunks roll over to the wireline trunks because it defeats the reason for separating the trunks to begin with.
- (8) The PSAP may want to compile a list of all known tower sites in their jurisdiction or determine if such a list already exists. While there will likely be additional sites identified through the deployment process, compiling a list early will save time later and will also allow the PSAP to confirm all towers have an assigned address. If towers are identified that have not been addressed, the PSAP may want to consider assigning an address unique to the tower site and not shared with any surrounding structure. This will aid in the identification of a wireless Phase I call.

3.2.2. Initial 9-1-1 Service Provider Contacts

The project manager should schedule a meeting with 9-1-1 service provider marketing and technical representatives to determine their ability to provide wireless 9-1-1 services and their preferred technology. With the 9-1-1 service provider and other equipment vendors, determine the impact on all 9-1-1 equipment, current trunk configurations, expansion trunking decisions, ALI display format, mapping, and computer aided dispatch systems. Determine what options are available for upgrade or replacement.

There is no provision, in any legislation, that requires the County to blindly accept the service in the manner the Wireless Service Providers (WSPs) or 9-1-1 service provider prefer to provide it. Choices are available and technology requirements are neutral under most State and FCC regulations. Cost may be the controlling factor.

There are generally three technology options for deployment of Phase I (CAS, NCAS and HCAS) and two for Phase II (NCAS and HCAS). The project manager should survey the WSPs operating in the locality to determine which technologies they are offering. This will have an impact on the upgrades that may be necessary. As an example, the CAS solution requires the PSAP equipment to be able to receive and process a 20-digit ANI. Most equipment is only capable of 8 or 10-digit ANI unless the equipment is relatively new (since 2000) or has been upgraded.

The PSAP project manager must order the necessary upgrades and obtain a schedule for their implementation from the 9-1-1 service provider. In accordance with the Richardson ruling of the FCC, the necessary upgrade must be completed within six-months of the PSAP's service request for the request to be valid. If the upgrades or equipment replacements are scheduled to take longer than six months, the project manager should wait to make the service requests until the completion is

within six months or can make an early request (recognizing that the six-month timeframe of the FCC order does not start right away).

The project manager should request a copy of the PSAP's MSAG from the 9-1-1 service provider during this initial contact. The MSAG will be helpful later when completing the routing data sheet. In some areas, the 9-1-1 service provider will create the MSAG for the wireless deployment. In such cases, the importance of the MSAG diminishes, but it is still a good idea to obtain a copy of the MSAG as a reference. Requesting it early ensures that it is available when and if it is needed.

3.2.3. Notifications

Once the project manager has determined that the PSAP is ready or will be ready within six months, the request letter should be sent. The initial communications between the PSAP and WSP can set the tone for many of their future dealings. It is important that as much information is shared as possible in the early stages to ensure that problems stemming from miscommunications are avoided. Identifying the WSPs who should receive the request can be difficult. Several Internet resources are available to assist such as [http:// www.fcc.gov](http://www.fcc.gov) or [http:// www.wirelessadvisor.com](http://www.wirelessadvisor.com)

The entire deployment process begins with the request letter being sent by the PSAP to the WSP. The request letter should be sent certified or by any other means that records the name of the recipient. This will help avoid future confusion about who and when the request letter was received. Be sure to send a copy of the request letter sent to the WSPs to the 9-1-1 service provider and state 9-1-1 coordinator, if one exists.

To ensure that the PSAP is ready to deploy the service, the request letter should include copies of upgrade orders and any other documentation showing the PSAP is ready to deploy service. The ATIS (Alliance for Telecommunications Industry Solutions) Emergency Services Interconnection Forum (ESIF) has developed a PSAP Readiness Checklist for Phase II, which may provide sufficient documentation of readiness. The checklist may be downloaded from ESIF's website at <http://www.atis.org/atis/ESIF/ESIFdocs.htm> and should be included with any Phase II request letter. While a request without this information is a valid request, this type of information will be requested later in the process if it is not provided with the request. Most important of all, the request letter from the PSAP should identify the single point of contact authorized to work with the WSP on the deployment. This will be the point of contact for the WSP to ensure that all communications are received and processed appropriately.

After receiving the request for service, the PSAP can expect the WSP to acknowledge the receipt of the request. It is likely that this correspondence will simply acknowledge the request and indicate that they have referred the request to their service provider. Most WSPs use a third-party provider to deploy the wireless enhanced 9-1-1 services. It is also likely at this stage for the third-party provider to contact the PSAP representative identified in the request letter to introduce him or herself and talk briefly about how the deployment will be handled. It is at this stage that the WSP or third-party provider will request the general PSAP information if it was not provided in the survey with the request.

Finally, but probably most importantly, it is the PSAP responsibility to notify the WSP and third-party provider of changes in their status or the timeline for their readiness. Often the request for service will be sent before the PSAP is actually ready to receive the service. This is allowable as

long as the PSAP plans to be ready within the 6-month deployment window. If circumstances change it is important for the PSAP to notify all other parties.

Face-to-face kickoff meetings that had been customary in the early stages of wireless E-911 deployment are rarely conducted at this point. In unique situations, a face-to-face meeting may be appropriate, but in such cases, a regional approach is desirable to maximize the number of PSAPs able to participate in the meeting. A conference call is an appropriate substitute and should still be conducted on a regional level, if possible. A separate conference call will likely be necessary for each of the WSPs since the WSP may need to disclose proprietary information. This initial conference call is an excellent way to set expectations and make sure everyone is starting from the same point.

The project manager should establish a date for the first planning meeting or conference call with each WSP, the required 9-1-1 service provider, and the Development Implementation Team allowing at least 30 days notice. All parties should be told that their participation in the call is MANDATORY.

3.2.4. Planning Meeting

The planning meeting or conference call should be conducted with all of the following participants:

- The Development Implementation Team
- All Wireless Service Providers (WSPs) (Include any subcontractors they utilize)
- Local 9-1-1 service provider
- Possible CAD and/or Premise equipment vendors if required
- Mapping vendor, County GIS Department

The meeting or call should be rescheduled if one or more is unable to make it. If the meeting is held in person, strong consideration should be given to also allowing participation by conference call. Travel costs may prohibit some participants from traveling to a meeting especially considering the number of PSAPs that may request service. Conducting the meeting or call without everyone will likely lead to the need for another meeting or call. It may be necessary to defer discussions of proprietary WSP information if more than one WSP is represented at the meeting or on the call. If the information cannot be discussed specifically, the discussion can focus on when and in what venue the necessary information can be shared.

Some WSPs or some localities require the execution of a service agreement. Though not required (but permitted) under the FCC order, the project manager must determine if a service agreement is necessary. If so, the proposed agreement must be shared with the parties to the agreement during the meeting. The proposed agreement may be provided by the WSP or there may be a standard agreement available from the locality or state.

There is significant variance in how much of the deployment process the WSP is willing to complete prior to these documents being in place. In some cases, the WSP's will require the nondisclosure document to be signed prior to any deployment activities taking place. Other situations may arise where the WSP's will require service agreement finalization prior to trunks being ordered. Still other deployments will be allowed to proceed to pre-production testing, requiring all agreements to be completed just prior to final test and deployment.

Though not a responsibility of the PSAP project manager, interconnection agreements have on occasion delayed the deployment of service. As a result, it may be beneficial during the planning meeting to determine if interconnect agreements between WSP's and 9-1-1 service provider are signed and in place. If not, inquire as to the expected date of completion and whether the lack of an agreement will impact the deployment schedule.

During the planning meeting attempt to resolve the following issues at this meeting:

- The method of wireless Phase I and Phase II call delivery to be employed. It will be Call Associated Signaling (CAS), Non-Call Associated Signaling (NCAS w/SCP or NCAS w/WID) or a Hybrid delivery solution.
- Discuss how the number of trunks from each WSP to the routing 9-1-1 tandem will be installed. In most cases, this is solely a WSP responsibility and there is no cost to the PSAP. Also, determine the trunking and signaling requirements between WSP's MSC and the 9-1-1 selective router. The PSAP must be careful to not get drawn into any cost recovery requirements during these discussions.
- WSP should show a plan for congestion control (management of the volume of calls from any one area).
- Determine the number of separate wireless 9-1-1 trunks necessary from the 9-1-1 tandem to the primary PSAPs. (Separate wireless trunk groups provide a guard against the blocking of wireline 9-1-1 calls in the event of a major public incident). Do not simply duplicate the quantity of wireline trunk groups that are current at each primary PSAP.
- Discuss the redundancy and diversity of the WSP's connectivity to the selective router and the PSAP trunking.
- Identify if any of the players are utilizing subcontractors. Understand the role and responsibilities of the subcontractors, as well as who is accountable for their performance.
- Determine any special requirements that may be placed upon the PSAP. Such requirements could include a special upgrade need to the PSAP's CPE or burdensome testing requirements.
- Determine if any special costs will be incurred by the PSAP. Obtain details of such costs in writing. One example of this may include when the PSAP has an on-site or standalone ALI database. A router and special data circuits will be required to allow the receipt of wireless data.
- Establish a mechanism for the Wireless Service Providers (WSPs) to interface with the 9-1-1 service provider so that each understands the others role. They will need to communicate regarding the ordering of trunks from the MSC to the selective router and database access. Establish a working relationship and ensure it continues beyond implementation.
- Identify the primary contacts for all players in the system so that everyone knows who to keep in the loop. Identify the specific individuals in each company that will be managing

their portion of the implementation. Obtain telephone numbers, pager numbers and email addresses.

- Identify the NENA company ID and 24 X 7 contact number for each WSP. Ensure this number is at the PSAP BEFORE the testing starts.
- Arrange for individual meetings, if they are deemed necessary, for the discussion of proprietary information, anticipated workload, cell routing, and subscriber base issues.
- Discuss any applicable state or local legislation or regulations. The state public utility commission regulates local exchange carriers. The Wireless Service Providers (WSPs) are only regulated at the federal level.
- Set time lines to move forward when all information is received. Review a copy of your Phase I and II letters with each WSP. Ask for the WSP response letter if not received prior to this meeting.

3.3. Routing Sheet and Associated Database Standard

3.3.1. Initial establishment of routing

The next interaction between the PSAP and WSP will most likely be to initially establish the proper routing for each tower. The process begins when the WSP or third-party provider sends the PSAP a list of all of their wireless communications sites in the PSAP's jurisdiction, often referred to as a routing data sheet. Accompanying the routing data sheet should be a map that shows the physical location of each of these sites including the cell sector orientation. Typically, these sites will be communications towers; however, the sites may also be a water tank, a tall building, a power transmission structure or any one of a number of other tall structures. One variation on this step in the process is that before the routing information is sent, the WSP or third-party provider may send the PSAP a map confirming their jurisdictional boundaries. In either case, the jurisdictional boundaries of the PSAP must be identified. Additionally, the PSAP should identify any areas that are currently being annexed that will become part of its jurisdiction during the deployment process.

Each site may have an omni-directional antenna (meaning that it receives and transmits 360 degrees around the site) or a sectored antenna (meaning that it receives and transmits directionally). A sectored antenna may have two or more sectors with each sector concentrating its wireless coverage in an area falling to either side of the azimuth of the sector bearing.

The routing sheet will list each site including each sector. The orientation of the sector, based on compass directions, will also be listed (i.e. NW, SSE, WNW, etc.). You will need the radius information provided on the spreadsheet or from an RF coverage map to determine PSAP routing. If using the radii supplied on the spreadsheet, it is recommended that you confirm whether or not the radii listed is default (1 mile) or estimated actual which could be much greater than one mile. This information has an impact on routing. The routing sheet will also list the address, longitude and latitude for the site. The map that accompanies the routing sheet will display the location of the site and will indicate the approximate coverage of each sector either with a "pie wedge" or the actual predicted coverage of the sector based on a propagation model. It is important to note the third-party provider is not in the business of producing maps for PSAPs. PSAPs will often request

additional maps from the third-party provider to display in the PSAP or to use as reference. While these are worthwhile uses, it is not part of the work that the third-party providers perform. As a result, the PSAP should expect that such requests are refused or are provided at an additional cost.

The purpose of the routing sheet and map are to allow the PSAP to determine the appropriate routing for each site and sector and to confirm the site information (address, latitude and longitude, etc.) that will be displayed on the ALI when a call is received. The determination of routing may best be accomplished in a regional approach. It may not be the locality in which the site is located that gets the calls from that site. The wireless signal does not end at political boundaries. It may be appropriate to route the site based on the area covered or where the highest density of population exists. Conducting a regional meeting with several PSAPs will ease the process of determining routing. This allows each PSAP to discuss the routing and come to agreement in a cooperative environment.

The WSP must ensure that the tower address has been obtained from the proper addressing authority for the jurisdiction that the tower resides in. This is usually done prior to applying for the building permit. It is the PSAP's responsibility to research the correct information for the routing sheet. The information provided by the WSP or third-party provider is the best information they have though it may be incorrect. Great care should be taken by the PSAP to ensure that the information returned to the WSP or third-party provider is complete and accurate. The PSAP must also ensure that updates are made to their MSAG (and any other system interfaced to the ALI data stream, such as CAD or mapping) to match the tower addresses. This will ensure that the tower addresses display properly and will be entered properly in the ALI database.

The WSP may also ask for default and overflow routing information on the routing data sheet. If not on the routing sheet, the WSP will request this information in another manner. Default routing occurs when there is a failure of the standard routing. There are various levels of default routing. It is important for the PSAP to understand default routing and provide information to the WSP regarding where the PSAP would like to route them. Typically a 10-digit line is utilized for the default route, but care should be taken to ensure that the default line is answer with a similar priority to 9-1-1. Overflow routing occurs when all of the trunks are busy. There are two places this can occur. The first is between the MSC and selective router. This overflow routing is controlled by the WSP. When all trunks are busy, a call may be routed to another line or simply provided a fast busy signal. A fast busy signal is most common and is recommended in most situations for congestion control. The second place an overflow situation may occur is on the trunks between the selective router and the PSAP. The 9-1-1 service provider controls this overflow routing. They, too, can overflow route to another line or fast busy, but they can also (though it is not recommended) overflow to the wireline 9-1-1 trunks.

Sometimes the transmittal that accompanies the routing sheet and map will indicate that the PSAP must return the information within a short period of time. Regardless of the amount of time required, the PSAP may take more time, but needs to notify the WSP or third-party provider of the delay. Once the information has been verified or corrected, the completed routing sheet must be returned to the WSP or third-party provider (as indicated on the transmittal).

Once the WSP or third party provider makes the changes indicated by the PSAP, the WSP or third-party provider must send the PSAP a copy of the finalized routing sheets. This "as built" list allows

the PSAP to confirm that all of the requested changes were made. The PSAP should keep a copy of the final routing sheet for their records and as source of data for mapping display systems.

Alternate routing is also an issue that must be address though it does not involve the WSP. Many PSAPs have a plan in place to reroute 9-1-1 calls to another PSAP or location should an evacuation of the primary PSAP become necessary. The 9-1-1 service provider typically performs this rerouting of the 9-1-1 calls. Whatever the arrangement, if alternate routing is provided for wireline 9-1-1, the same accommodations should be made for alternate routing the wireless trunks as well.

3.3.2. Data for mapping display systems

Many PSAPs install mapping display systems in order to plot the wireless 9-1-1 calls in Phase II. A common data layer in these systems is a layer showing the wireless tower sites including sector coverage. This allows site information to be displayed graphically when a call is being processed from that site. The problem becomes one of how to obtain the information from the WSP or third-party provider to have it loaded. Due to the vast number of systems and the vastly different formats in which they utilize the data, it would be unreasonable to expect the WSPs or third-party providers to produce this data in the multitude of formats that may be required. As a result, this data should be pulled from the routing sheets provided early in the implementation of Phase I. All of the necessary data for the mapping display system should be available on the routing sheet. If it is not or if another format is absolutely necessary, a special request should be made of the WSP or third-party provider but the PSAP should expect the request to take some time and be at an additional cost.

Since the routing data provided to the PSAP was only a snap shot of the sites at the time Phase I was requested, it is imperative that updates to the data be sent to the PSAP any time changes are made after the finalized routing sheet is produced. This will ensure that the PSAP has the most up-to-date information and can load this into their mapping display system.

3.4. ALI Database Delivery Standards

The Phase I and Phase II data are provided to the PSAP through the ALI data stream. However, to accommodate the new information, the existing ALI query response format must be modified. Contact the ALI database provider to determine if an expanded ALI response format has already been established. If so, obtain a copy. Also determine whether there is any latitude for modification of this format. The format should be provided as a data structure that identifies the field name and length for the entire record. It is important to understand that the format will only contain fields that exist in the current ALI database and when specific fields do not exist for a data element, the data may be inserted into another field. The ALI database provider may have little control of how the data appears within each field. However, the PSAP Authority can have impact on what fields are used to carry a given data element. NENA has generated recommendations for Wireless ALI field content standardization, in order to enable consistency of dynamic data provision for wireless E9-1-1. See NENA Data Standards and Technical Information Documents.

Contact each WSP to determine how they will be populating each field within the ALI record. Most of the fields such as longitude and latitude are straightforward and are populated consistently. The most common variation among the carriers is the display of cell sector information. Since there is no specific field for sector information, one WSP may append this information to the street address

field while another may use the community field. Where the sector information appears may affect whether calls can be routed by sector or just by cell tower, so it is important to understand the intended methods for this. Understand that this is not something the ALI database provider can change since they are passing the data by field name and not by its contents.

Once the final format is determined, it must be provided to any vendors whose system interfaces with the ALI data stream. Most often this is primarily the CAD system vendor, but may also include a mapping vendor, if mapping is not provided through CAD. The response format provided by the ALI database provider must be forwarded to these vendors and modifications must be made to the systems to accommodate the new format, and any variations on field data content. Close coordination of implementing the new format is essential. If the new format is activated before the system changes, the system interfaces may not perform properly. The same is true if the system modifications are made before deploying the new format. Both changes should be made and tested at the same time or as close together as possible.

Though the PSAP typically has little involvement in the establishment of the wireless MSAG records, assignment of ESRK and ESRD ranges and provisioning of the WSP's MSC, the PSAP can ensure that each of these tasks is being completed. On occasion one of these tasks will be overlooked and will not be discovered until testing. Of course, this will delay the deployment of service. This type of delay can be prevented or reduced by a simple question from the project manager.

3.5. Geographical Information Systems (GIS)

3.5.1. Mapping Display System

The PSAP must determine how the longitude and latitude will be located in their jurisdiction. While there is no regulatory requirement that a PSAP have an automated mapping system it is highly recommended depending on the number of calls received by the PSAP. In lieu of an automated mapping system, a PSAP could use paper USGS maps to plot the longitude and latitude, but this is a very time consuming process and will require extensive training of the PSAP staff.

There are several options for mapping display systems, but they generally fit into one of four categories.

3.5.1.1 CAD Based Mapping

With a CAD based system, the same vendor that provides the CAD system provides the mapping display. This solution often provides the mapping solution with the greatest functionality since many CAD based mapping system provide CAD features in the map in addition to the typical mapping features. As an example, the user may be able to change status of units through the mapping display as well as display incident detail information. It may also allow the PSAP to procure the mapping system more easily since existing contracts may be in place that can simply be modified or expanded.

3.5.1.2 CPE Based Mapping

Many of the current CPE vendors offer integrated mapping solutions. These solutions offer tight integration with the telephone system and often have hooks to allow some interface to other systems such as CAD.

3.5.1.3 Third Party Mapping

Other mapping systems are available specifically design for use in a PSAP. Several of these systems are provided by companies that perform mapping and addressing functions for initial deployment of E-911. These systems may also provide hooks to interface to CAD or other systems. In fact, some CAD and CPE vendors actually market mapping display systems from these vendors as part of their system.

3.5.1.4 Commercial Off the Shelf (COTS) Mapping

Though not specifically designed for a PSAP, there are several software mapping applications available commercially. They tend to be very inexpensive (under \$100) and the quality varies greatly. Since these applications would not interface with any other systems (thus requiring manual entry of the longitude and latitude information), it would likely not be a good choice for a busy PSAP. The accuracy and age of the data provided with the system may also impact its usefulness in some areas. However, for a small PSAP that just needs to be able to plot a longitude and latitude on a few calls, it may perform well enough to satisfy the need. A COTS solution would definitely be superior to a paper solution.

3.5.2. GIS Data

With the exception of the COTS solution, which is typically provided with data, no matter which mapping display solution is selected, GIS data will need to be provided to drive the map. There is a wide variety of option available for GIS data both in format and content. Work closely with the selected mapping display system vendor to determine the data requirements of the specific system. Try not to reinvent the wheel by determining if data is available from another source in the jurisdiction. There may also be a state GIS program that can provide some of the required data. The important message is that the PSAP should not look at this data as being solely for the PSAP. Other users of GIS data may already have data or be able to share the cost of its acquisition. If no data is available from a public sector agency, GIS data may be available from a commercial source. There are several companies that provide mapping data commercially for other applications like web-based mapping sites, etc. The accuracy and age of the data varies in different areas of the country so the quality of the data must be evaluated. Refer to NENA's "A Public Safety Answering Point Managers' Guide to Geographic Information Technology" (available on the NENA website) for more information about GIS system and data.

3.6. Implementation Testing Standard

3.6.1. Phase I Testing

3.6.1.1 Scheduling

As a general rule, Phase I testing should be scheduled with all parties on the testing team by the WSP or third-party provider at least five (5) business days prior to performing the testing. The testing team must include at least the WSP, third-party provider, PSAP and 9-1-1 service provider. The initial request for testing shall indicate who will be responsible for coordinating the testing (the testing coordinator). The testing coordinator will be responsible for notifying the PSAP and 9-1-1 service provider of the general plan for the testing to include the following information:

- Who will be involved with the testing;
- How many drive testers will be conducting test calls;
- How many test calls will likely be made and over what period of time; and
- Will a conference bridge be utilized during the testing.

The PSAP should not agree to conduct Phase I testing until they are actually ready to deploy the service (training conducted, etc.). It is not recommended that testing be conducted well in advance of deployment. It is best to deploy the service as soon as successful testing is completed. As a result, the PSAP should conduct any necessary telecommunicator training before testing is conducted. The content of the training is beyond the scope of this document, but it is important to remember the training must be conducted prior to Phase I being implemented. Additionally, standard operating procedure for processing wireless calls should also be developed including how and when to obtain subscriber information and the procedure for processing wireless 9-1-1 hang-ups.

Since the testing schedule is predicated on completion of testing at other PSAPs, the schedule may slip or may be accelerated (if another PSAP cancels) as the testing date approaches. It is the responsibility of the testing coordinator to communicate any changes to the schedule to all parties on the testing team. Any member of the testing team may request a change to the schedule, if necessary. Additionally, during the testing, the PSAP or any other party may request a temporary stoppage or a cancellation of testing should conditions in the PSAP change or the situation warrants it.

3.6.1.2 Switch Level Testing

There are two levels of Phase I testing, switch level and sector level. The switch level testing, sometimes referred to as profile testing, ensures that the switch is able to process calls from different types of handsets and during different types of failure situations. It is not necessary to test these conditions with every site. Even though a single test performed on each MSC is likely sufficient, switch level testing should be performed at each PSAP to ensure correct performance and to allow the PSAP to experience each type of failure.

Additionally, connectivity testing must also be performed on the trunks between the MSC and the selective router. While this may or may not result in a few calls being routed to the PSAP, it is

essential that this testing be accomplished before any other testing is attempted. This testing is often performed when the WSP's trunks are installed which may be as much as 30-days prior to system testing. The PSAP trunks also need to be tested. This testing should also be performed by the 9-1-1 service provider and PSAP prior to any other testing.

3.6.1.3 Handset test

Each WSP can provide wireless service through multiple handset types (typically between 3 and 5 different types). Examples of different types of handsets include:

- Home – analog
- Home – digital
- Roamer
- Uninitialized (out of box and deactivated)
- International

At least one test call must be placed from each type of handset that is available to the general public. Not all WSPs will need to test all handset types. A WSP with an all-digital network does not offer analog service and therefore could not test an analog handset.

The actual ALI display within the PSAP will vary based on the WSP but generally each call should provide the appropriate Phase I information with the exception of the uninitialized handset. Since the handset is uninitialized, no call back number is available. The PSAP should take note of what is displayed as the call back number for the uninitialized handset. The call back number for such handsets is handled differently depending on the WSP. The number sent may be the last number assigned to that handset, the MIN of the handset or a unique number to identify it as an uninitialized handset (i.e. 911-123-4567).

The results of each test call should be documented. While only one call is necessary to test each handset, additional test calls may be necessary if errors are found.

3.6.1.4 All trunks busy (overflow)

There are two places that all trunks can be busy, between the MSC and the 9-1-1 selective router and between the selective router and the PSAP. Both locations must be tested for an all trunks busy condition; however, not all of this testing can be repeated with each provider.

3.6.1.5 MSC to 9-1-1 Selective Router

To test the trunks between the MSC and selective router, all trunks within the trunk group must be placed in a busy status. When all trunks are busy, a test call 9-1-1 is placed. The call should route as requested by the PSAP in the initial survey. When the test is completed, the trunks must be made available once again.

This test can only be performed once for each trunk group. If the trunk group is shared among two or more PSAPs, only the first PSAP can perform this test since live calls may be on the trunks and

busying the trunks could block an actual 9-1-1 call. If the trunk group is shared, the first PSAP must perform the test and report the results to all of the other PSAPs served by that trunk group.

3.6.1.6 9-1-1 Selective Router to PSAP

To test the trunks between the selective router and the PSAP, all trunks within the trunk group must be placed in a busy status. When all trunks are busy, a test 9-1-1 call is placed. The call should route as requested by the PSAP in the initial survey. When the test is completed, the trunks must be made available once again.

This test can only be performed with the first WSP and only if the trunks are not shared between wireline and wireless E-911. If the trunk group is shared between wireline and wireless E-911, busying the trunks could block an actual 9-1-1 call. If the trunk group is not shared, after the first WSP has deployed, performing this test could again block calls.

3.6.1.7 Alternate routing

If the PSAP has an alternate routing capability (the ability to forward 9-1-1 calls to somewhere other than the PSAP) for use during evacuation scenarios, the PSAP must test this capability for wireless 9-1-1 calls. Though this is beyond the control of the WSP and third-party provider, the switch level testing provides an excellent opportunity to test this capability with the 9-1-1 service provider. This test can only be performed with the first WSP and only if the trunks are not shared between wireline and wireless E-911. If the trunk group is shared between wireline and wireless E-911, alternate routing for wireless should work the same as wireline and need not be tested beyond the routine testing of wireline alternate routing. If the trunk group is not shared, after the first WSP has deployed, performing this test could send live calls to the alternate location.

3.6.1.8 Default routing

There are two conditions that can result in a wireless 9-1-1 call routing based on default parameters. The first is that the tower does not have routing information assigned to it or for some other reason does not provide it. In this scenario the MSC knows which tower has received the call, but does not know where to send the call based on that tower. In such cases, the call is sent to the default route for the MSC. If the PSAP being tested is not the default route for the MSC this type of default routing does not need to be tested, but the PSAP must be told which PSAP will receive their default routed calls in this scenario.

The second type of default routing is when the MSC does not provide correct routing information to the selective router. In this scenario the selective router will route the call based on the trunk group on which the call was received. If the PSAP is the only one served by that trunk group then the call will still route to the appropriate PSAP. If a single trunk group serves multiple PSAPs, then the call will route to the default for that trunks group. A call testing the default route should be made regardless of whether the PSAP being tested is the default route, but the test must be coordinated with the PSAP that is the default route.

3.6.1.9 Transfer Testing

The routing of wireless E-911 calls is much less accurate than the routing of wireline calls. As a result, a PSAP may be required to transfer calls to an area larger than they had to in the past. The transfer process must be tested to ensure calls will be completed and ALI data is transferred (if appropriate). ALI information will only be received in the transferred PSAP if it served by the same selective router as the original PSAP or if inter-tandem trunking is available between tandems. Where the call is transferred to a PSAP on a different, unlinked selective router, the call will be received on a ten-digit number and will lack ALI data. A PSAP should consider expanding their transfer list as a result of the implementation for wireless E-911. This will speed the transfer of calls after deployment.

3.6.1.10 Sector level

As the name implies, sector level testing is performed at each site and on each sector at a site. The process involves a person, the drive tester, driving from area to area within the PSAP's jurisdiction making calls on each site and sector. The tests must be performed through an actual drive test. It is possible to simulate test calls from each sector at the MSC, but this practice **is not** an adequate test of the system and is therefore **not recommended**.

As a general rule of thumb, only one test call is necessary for each sector to ensure that the call is routing correctly and displays the correct information in the PSAP (on the ALI display). Additional calls will be necessary should the first test fail. It is the responsibility of the WSP or third-party provider to ensure that all sites and sectors pass the test, but the PSAP is encouraged to also monitor the testing to ensure that the displayed information matches the data the PSAP provided on the routing sheet. This will also ensure that the PSAP has been kept up-to-date on the routing information since the final routing sheet was provided.

Often a conference call bridge will be established for larger deployments. A conference bridge is recommended during any testing that involves more than one drive tester. The conference bridge provides a conduit for all parties to identify and resolve problems and for the testing to be suspended should that be necessary. With only one drive tester, activities can be coordinated through the test calls themselves. If the PSAP needs to suspend the testing, they need only tell the driver tester the next time he/she calls.

As each site and sector is tested, it is recommended that the site be left as a live Phase I deployment. While it is possible to disable Phase I at each site after testing and deploy all sites at the same time at the conclusion of testing, this adds a possible point of failure that will not be tested again until a live 9-1-1 call is received. It is best to consider the site completed and left as Phase I deployed.

3.6.1.11 Documentation of testing

The WSP shall be responsible for documenting the completion of testing with a letter to the PSAP (copying the other stakeholders) within seven (7) days of deployment. The documentation should note any outstanding issues that are still to be resolved by the WSP or third-party provider with a schedule for the resolution of those items. If requested by the PSAP, the WSP or third-party provider should provide the PSAP with a copy of the actual test results. While this should usually not be necessary, the PSAP may need the information to ensure testing was completed properly.

3.6.2. Phase II Testing

Phase II testing shall follow the same guidelines as testing for Phase I except that for a handset based solution a location capable handset must be added to the switch level test and must be used by the drive tester for the sector level test. Like with Phase I testing only one test call is required, additional calls may be considered if all parties agree there is a value to be gained.

Prior to the start of Phase II testing, ensure that the Third Party Database Provider and the WSP have verified the Cross-Over-Tables in the MPC. That the ESRKs for each PSAP being tested have been verified as properly assigned to the specific PSAP being tested and that the proper NPA has been assigned for that region to ensure inter-state misroutes are kept to a minimum. All of this should be certified in an advance copy email to all parties involved in the testing. Also, remember, a No Record Found (NRF) during testing means that the format being sent to the MPC has some type of format programming error and must be resolved by the vendors, NOT THE PSAP.

It will also be necessary for the PSAP to rebid the ALI database for each test call received. It is therefore imperative the PSAP tests their rebid capability prior to beginning Phase II testing. The 9-1-1 service provider can assist the PSAP with this test. Some customer premise equipment (CPE) may appear to have a rebid capability, but the feature may not cause a new query to the 9-1-1 database and may only redisplay the ALI record from the ALI controller. The CPE must be capable of querying the ALI database a second time to display the Phase II data.

The WSP should also test the position determining entity (PDE) prior to conducting the testing with the PSAP. This will allow the WSP to ensure that the PDE is calibrated and providing accurate location information prior to involving the PSAP in actual testing. This testing is conducted internally by the WSP and does not involve the PSAP receiving calls.

When the call is received in the PSAP, the call taker should ask the drive tester for their location. If the PSAP has a mapping display system, the location provided on the ALI display should be plotted and compared to the location provided by the drive tester. If the PSAP does not have a mapping display system readily available, the location provided by the drive tester and the latitude and longitude provided on the ALI display should be compared at a later time. Testing should not be delayed by making this determination.

It is important to note, however, that this testing is not to test the accuracy of the system, but rather is intended to test the infrastructure's ability to process the call. Testing for the compliance of the Phase II system with the FCC order requires a larger number of test points to be statistically valid and usually requires an area larger than a single PSAP to be accomplished. Compliance testing is beyond the scope of this document.

3.7. Post Deployment Issues

3.7.1. New or re-homed switches/sectors

From time to time after initial deployment of Phase I, a WSP may add a new site/sector or may move a site from one MSC to another (a process called re-homing). All new or re-homed sites and sectors must be retested in the same manner they were for Phase I or Phase II. The WSP must notify a PSAP of any new sites in their jurisdiction using the same format as the original routing sheet. From

data preparation to testing, new sites should be processed with the same care and detail as sites were for the original Phase 1 implementation. This will ensure that the PSAP is aware of all new sites and that they may load information about the site into their mapping display system.

3.7.2. 24-hours contact information

It will be necessary from time-to-time for the PSAP to contact the WSP after hours because of a need for additional information or to report a problem with the system. While a few WSPs have integrated these functions into a single telephone line, generally, there will be different contact number for each of these functions. Often requests for additional information (subscriber information, site information, etc.) will be processed through the WSP's legal compliance office. Trouble reporting is often processed through the third-party provider. It is critical that the PSAP obtain this contact information early in the deployment process so that procedures within the PSAP can be developed and appropriate training can be provided. The WSP or third-party provider should provide this to the PSAP when or before the routing sheets are distributed. The PSAP should enact any procedures in time for the telecommunicator training sessions, but must have them in place before testing.

3.7.3. "Planned" outages, upgrades, etc.

While not all outages are planned, preventive maintenance, upgrades and other issues may require that the Phase I network be disabled for a period of time. The WSP or third-party provider shall notify all affected PSAPs and 9-1-1 service providers prior to the any planned outages or upgrades. The notification should indicate to all parties the duration of the outage and what level of service should be expected during the outage or upgrade.

3.7.4. Audit of routing data (after initial)

PSAPs on occasion have expressed an interest in auditing the routing data periodically (usually annually) after deployment. While this sounds like a simple request, the sheer number of PSAPs nationally prevents this from being common practice. The amount of time necessary to audit every existing deployment would likely prevent new deployments from occurring. However, if a widespread problem is identified, a PSAP may need to request an audit. The WSP or third-party will keep the PSAP up-to-date with any changes to the initial routing sheet. If the PSAP begins to see calls where the ALI displays something different than what has been provided, the PSAP should bring this to the attention of the WSP or third-party provider. While some errors such as this can be expected, when they become widespread, it may be necessary to look at routing again.

3.7.5. Ongoing Testing

Post deployment testing is the responsibility of the PSAP. It is recommended that the PSAP conduct period tests to ensure that all calls are still being processed properly. This is especially important in areas where the call volume from wireless is not that high and normal activity does not test the entire network.

It is also recommended that each PSAP evaluate the established routing periodically based on actual call load. Routing decisions were initially made on based on maps that depicted the likely coverage

area of each site and sector. Once the PSAP has some historical data available, it is wise to revisit these routing decisions to determine if the optimal routing is being achieved. In other words, analysis of the actual call data may show that a high percentage (over 50%) of calls being received from one sector are being transferred to a neighboring PSAP. In this case, it may make sense to reroute that sector to the other PSAP, thus minimizing the number of transfers needing to take place.

3.7.6. Information Management

It is important for PSAP managers to monitor the performance metrics of their center. Because of the volume of calls that typically come from wireless E-911, it is important to especially monitor wireless 9-1-1 call load and performance. A management information system, which can be configured to monitor ALL PSAP activity that is generated and is within the PSAP's monetary reach, it is a highly recommended management tool. Some of the equipment within the PSAP, such as the CPE, CAD system (but remember not every call generates a CAD incident), voice logging system, etc., may be able to provide call load information. Additionally, the PSAP manager should try to obtain usage data from WSPs for MSC to tandem trunks and from the 9-1-1 service providers for tandem to PSAP trunks. Tracking this information will allow the PSAP manager to determine ongoing trunking requirements. Original trunking calculations are often based on estimated call load and must be verified against actual data. It may be necessary to add additional trunks. It is also important to monitor the call load on the wireline E-911 trunks to determine the impact of the implementation of wireless E-911 on wireline. Information regarding an increase in blocked calls or abandoned calls may signal a problem requiring additional investigation.

4. References

“A Public Safety Answering Point Managers’ Guide to Geographic Information Technology”