Final Report
on

Facilitating the Implementation of Emergency Wireless Communications

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Contract DTFH61-02-C-00015

by

National Emergency Number Association

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Executive Summary

During NENA's four-year project for the United States Department of Transportation (DOT), the availability of wireless E9-1-1 has increased substantially. From a handful of Public Safety Answering Points (PSAPs) basically serving as trial sites in late 2001/early 2002, Phase II (delivery of caller's location) is now available to almost 75% of the U.S. population. Or, placing it in another perspective, in 2001 there likely were no more than hundreds of wireless 9-1-1 calls with caller location, while in 2006 there will be 40 to 60 million wireless calls with caller location provided[1].

This NENA DOT project has significantly contributed to this major expansion in enhanced emergency services access for the public, while also insuring that such access worked correctly as the wireless industry underwent extensive changes.

From the 2003 wireless implementation videos, targeted to PSAPs, legislative officials, wireless providers and the public, to the 2004-05 standards and other documents developed to simplify and hasten Phase I and II implementations, the NENA DOT project covered various key areas essential to successful implementations.

With developed materials important to implementation combined with its partnership approach of working with the various segments essential to success, NENA staff, leadership and other very active members presented at national, regional and state conferences, hosted implementation-specific regional gatherings and in other more one-on-one approaches, conveyed assisting messages to implementation planners across the country.

While the Wireless Deployment Profile (WDP) helped track areas needing special assistance, it also provided up-to-date ongoing statistics showing successes. It continues to be used by federal, state and local leaders, along with other public and private entities, to check current status regarding Phase I and II deployment.

Simultaneously with the wireless E9-1-1 rollout across the U.S., the wireless industry was involved in extensive technology changes along with digital text telephone (TTY) government-mandated 9-1-1 access hardware/software upgrades and implementation, mergers/buyouts (national providers reduced from six to four, along with regional mergers also), Communications Assistance for Law Enforcement Act (CALEA) requirements, spectrum auctions, growth in consumer use of wireless data devices, and certainly not least, wireless number portability and pooling.

Using project resources, NENA was able to participate, and serve as lead where appropriate, across the necessary broad range of entities (telecommunications industry, federal government agencies, state/local government/emergency services authorities, 9-1-1 community, and many others) to not only advance wireless E9-1-1 implementations and access methods, but also

[1] Estimate calculated from NENA DOT project wireless implementation percentages and CTIA 9-1-1 call volume estimates, both of which are included elsewhere in this report. The range is offered because of a degree of uncertainty over Phase II capable handset penetration among some providers.

eliminate or minimize any negative effects from the many other changes going on simultaneously within the telecommunications industry.

While the NENA DOT project has been a significant contribution to the widespread rollouts of both Phase I and II, along with ensuring that wireless 9-1-1 access continues correctly when major technical and operational changes have happened within the wireless industry, there remains work to do. More than 50% of the counties[2], in the U.S., predominately rural, remain without Phase II, and 25% remain without Phase I. Wireless industry technological and operational changes of significance continue, pointing to the ongoing need to continue ensuring correct 9-1-1 access. The sharply increasing general public use of wireless text devices[3] and the significant value and use of such devices in the deaf and hard-of-hearing community, demonstrate the need to substantially improve the existing 9-1-1 networks in use across the country.

Recent months have also shown escalating marketing among younger age groups (particularly 8-12 years of age) by a number of entities within the wireless industry and it is increasingly important that various educational processes be developed to be sure that youth's wireless 9-1-1 access when needed in emergencies, is dealt with appropriately.

During the remaining months of 2006, several additional Phase II implementations will occur. This ongoing process is greatly assisted by the various materials developed within the NENA DOT project combined with wide-spread industry-government partnership at various levels that was developed as a significant byproduct of this project. These two key elements are essential to timely success. What remains to be done to implement in those areas of country, mainly rural and economically-limited, is to deal with the challenging funding and political issues in a creative fashion.

[2] NENA DOT wireless E9-1-1 implementation tracking

[3] SMS traffic more than doubles from December 2003 (2 billion messages per month in U.S.) to 4.7 billion per month in December 2004, according the FCC 2005 annual CMRS competition report.

Introduction

This final report titled "Facilitating the Implementation of Emergency Wireless Communications" summarizes the results of a 54-month program conducted by NENA for the DOT (Federal Highway Administration and National Highway Traffic Safety Administration). The program is generically referred to as the Wireless Implementation Project within DOT and the 9-1-1 community, so there are many references to that Wireless Implementation Project in the final report.

The project had a number of deliverables including the following:

- National Clearinghouse of information
- Wireless Deployment Profile
- White Papers on a variety of wireless 9-1-1 related topics
- Videos – oriented towards PSAPs, Wireless Carriers, and States & the Public
- Stakeholder forums – including NENA and APCO annual conferences, and critical issues forums
- Technical assistance – to PSAPs, wireless carriers, standards organizations, and other public safety associations and organizations
- Survey of counties to estimate Phase II equipment costs.

Since October 2001 a number of reports about wireless E9-1-1 have been commissioned or written by selected Federal agencies. Most notable are the following:

- FCC Report – October 2002 titles "A Report on Technical and Operational Issues Impacting the Provision of Wireless Enhanced 911 Services", often referred to as the "Hatfield Report"
- Government Accountability Office (GAO) Report – November 2003 titled "Uneven Implementation of Wireless Enhanced 911 Raises Prospect of Piecemeal Availability for Years to Come"
- Congressional Research Service (CRS) Report – January 2006 titled "An Emergency Communications Safety Net: Integrating 911 and Other Services"
- GAO Report – March 2006 titled "States' Collection and Use of Funds for Wireless Enhanced 911 Services"

All with the exception of the FCC Report have referred extensively to the USDOT Wireless Implementation Project and the information contained in the Wireless Deployment Profile.

Wireless Deployment Profile

Perhaps the single most visible product of the Wireless Implementation Project, the Wireless Deployment Profile has provided a four-year picture of the status of Phase I and Phase II implementation at the state and county level. The initial WDP was based on a detailed survey in 2002 of all 3135 counties in the U.S. to determine readiness for and deployment of Phase I and Phase II.

That survey was completed in the Fall of 2002, and showed 37 percent of PSAPs with Phase I and only 9 percent with Phase II. Project staff has continued to update the WDP on a continuous basis, from quarterly reports filed by wireless carriers to the FCC combined with calls to state and county 9-1-1 coordinators. Today wireless Phase I is available for 81 percent of PSAPs and Phase II for 62 percent of PSAPs. On the basis of population served, the number for Phase I is 86 percent and for Phase II the number 74 percent.

Considering that wireless E9-1-1 is funded almost exclusively at the state or local level, without any Federal funding, that amount of penetration since the passage of the Wireless 9-1-1 Act is very high, and shows the importance of emergency communications to the wireless carriers and public safety.

Initial Survey

The initial survey was developed in early 2002 by NENA staff with review by the USDOT project coordinator and staff. The decision was made to focus on state and county 9-1-1 coordinators as the source of information for the Wireless Deployment Profile. Project staff compiled a list of state coordinators, all of whom are members of the National Association of State Nine-One-One Administrators (NASNA), who in turn provided lists of county coordinators within each state. There were approximately 30 state coordinators at the time of survey development. NENA chapters were also a source of county coordinators, particularly for those states where no 9-1-1 coordinator was present. Finally, NENA's PSAP List was a source of county/PSAP coordinators where information from state coordinators and NENA chapters was not found.

Updates

A number of steps were taken to ensure currency of information in the Wireless Deployment Profile. These included:

- Updates from the FCC mandated quarterly reports from wireless carriers
- Calls to state 9-1-1 coordinator and state wireless coordinators
- Monitoring of news stories and other sources related to plans to implement or start implementation efforts
- Wireless Implementation Project resource rooms at NENA and APCO Annual Conferences in 2002, 2003, and 2004.

An important feature of the WDP was that all maps and summary information were updated daily – thus ensuring that the information was both accurate and accessible via the NENA web site.

As the project progressed, we found that many governmental organizations (e.g. DOT, FCC, GAO, CRS) as well as other organizations such as Cellular Telecommunications and Internet Association (CTIA), the E9-1-1 Institute and the National Governors Association relied solely on the Wireless Deployment Profile for wireless Phase I and Phase II completion information.

Web Site Development

The Wireless Deployment Profile has been posted to the NENA web site under the heading of USDOT Project since the results of the first survey became available. State maps and summary tables for important information have been updated daily so anyone going to the WDP will have the latest information.

Congressional Impact

Throughout the Wireless Implementation Project, NENA provided detailed information regarding wireless E9-1-1 Implementation to Congressional representatives and staff. Beginning in March 2003 at NENA's Annual "9-1-1 Goes to Washington" event, state-specific maps depicting wireless Phase I and Phase II completion status by county were prepared to support requests of Congress for 9-1-1 legislation and funding.

In 2005 and 2006 the state maps also had information by Congressional District to further educate Congress on wireless deployment for those areas they serve. These maps generated by project staff received high praise from those attending 9-1-1 Goes to Washington, and from Congressional representatives and staff.

Secretarial Initiative

The DOT Secretarial Initiative was formed to promote wireless E9-1-1 implementation. Under that Initiative, two separate groups were formed – a Steering Council comprised of representatives from leading 9-1-1 organizations and an Expert Working Group, which was a smaller group charged with coming up with a Priority Action Plan to be reviewed by the Steering Council and submitted to the DOT Secretary for action.

Priority Action Plan

The Priority Action Plan recommended six Priority Action Items. They include the following:

Priority Action Item #1 Establish Support for Statewide Coordination and Make Points-of-Contact

Priority Action Item #2 Help Convene Stakeholders in Appropriate 9-1-1 Regions

Priority Action Item #3 Examine Cost Recovery and Funding Issues

Priority Action Item #4 Initiate Program of Knowledge Transfer and Outreach

Priority Action Item #5 Develop Coordinated Deployment Strategy Encompassing both Rural and Metropolitan Areas

Priority Action Item #6 Implement Model Location Program

Project staff worked with an Expert Working Group made up of selected representatives from 9-1-1 agencies and organizations to develop the Priority Action Plan. The Expert Working Group then submitted the Plan to the Wireless Steering Council, comprised of a broad range of representatives from the 9-1-1 and first responder communities. Once approved by the Wireless Steering Council, the Priority Action Plan was recommended to the Secretary of the Department of Transportation for implementation.

The Priority Action Plan and Priority Action Items are described in detail in Appendix 3.

White Papers

Three white papers were written during the project. The first was prepared by NENA's GIS Subcommittee and addressed GIS and wireless issues. As the project proceeded, a second white paper on technical wireless issues was written. Finally, as accuracy became an issue during the waiver process, a third white paper on accuracy issues was prepared.

All three white papers were placed on the NENA Wireless Implementation Project web site for downloading to those who were interested in learning more about these key areas of wireless implementation. NENA distributed copies of the white papers at its Annual Conferences as the white papers became available, and they proved useful to other organizations (such as the Network Reliability and Interoperability Council (NRIC) and Emergency Service Interconnection Forum (ESIF)) in their work on 9-1-1 issues and future planning.

The three white papers may be found in Appendices 4, 5 and 6.

Wireless Implementation Videos

In 2003 NENA prepared three separate videos in support of the Wireless Implementation Project. Target audiences for the videos were:

- PSAPs
- Legislative officials and the public
- Wireless carriers

Scope/Audience

The 14-minute video for PSAPs provided a step-by-step process for PSAPs to implement wireless E9-1-1. It discussed how to use the Phase I and Phase II checklists as a guide to implementation.

The 8-minute video for legislative officials and the public was intended to provide general information regarding wireless Phase I and Phase II – information that could be used to garner support and funding for wireless E9-1-1 implementation at the state or county level.

The 12-minute video for wireless carriers was focused primarily on Tier III carriers generally serving primarily rural areas. Major wireless carriers had already begun to implement wireless

E9-1-1 phases, mostly Phase I, at the time of video production, yet there remained a need to assist Tier III wireless carriers with their implementation efforts.

A total of 7,500 videos were produced for PSAPs and legislative officials and the public – both the PSAP version and the one for legislative officials and the public were contained on a single video for multiple uses by PSAPs and by local officials. 500 videos were produced for distribution to wireless carriers.

Distribution of Video Tapes

Distribution of the 7,500 videos was through NASNA in those states with 9-1-1 coordinators, and directly to PSAPs by NENA where 9-1-1 coordinators do not exist. Most NASNA members preferred to distribute the videos within their respective states with an explanatory cover letter on official state letterhead. Others approved distribution directly from NENA to PSAPs within their state. We used NENA's PSAP Registry database to identify PSAPs in each state where no state 9-1-1 coordinator was present.

Distribution to wireless carriers was from a list of carriers obtained from the Federal Communications Commission.

NENA also distributed copies of all videos at the 2003 and 2004 NENA and APCO Annual Conferences. At these conferences, we arranged for a USDOT Wireless Implementation Project resource room where conference attendees (primarily PSAP managers and state 9-1-1 representatives) were encouraged to verify and/or update status of wireless E9-1-1 deployment for their respective states/counties/PSAPs. This also encouraged numerous dialogues regarding planning for future implementation. In Denver at the 2004 NENA Annual Conference, we had a continuous video with all three videos shown on a large screen in the Exhibit Hall. Everyone who visited the Exhibit Hall was able to view the video, which was a focal point as attendees entered the exhibit area.

Distribution of the videos included a special issue of NENA News magazine that was devoted to wireless E9-1-1 issues. This further aided PSAPs in their implementation efforts, and was an important component of the project's education of PSAPs, government officials, wireless carriers, and the public.

Technical/Operations Assistance

Wireless Checklists

During the NENA DOT four-year project, wireless E9-1-1 has increased substantially. From a handful of Public Safety Answering Points (PSAPs) basically serving as trial sites in late 2001/early 2002, Phase II (delivery of caller's location) is now available to almost 75% of the U.S. population. Or, placing it in another perspective, in 2001 there likely were no more than

hundreds of wireless 9-1-1 calls with caller location, while this year, after the four year NENA DOT project, there will be 40 to 60 million wireless calls with caller location provided[4].

This NENA DOT project has significantly contributed to this major expansion in enhanced emergency services access for the public, while also insuring that such access worked correctly as the wireless industry underwent extensive changes.

During the late 2001 to early 2006 time period when the wireless industry had significant customer growth (an estimated 63%[5]), wireless E9-1-1 Phase I (routing by cell site/face and delivery of callback number and cell site/face location to PSAP) grew from just over 20% PSAP penetration to 81%[6], almost quadrupling.

Simultaneously with the wireless E9-1-1 rollout across the U.S., the wireless industry was involved in extensive technology changes (such as carriers moving from TDMA to GSM, 2G and 3G planning and rollouts), along with digital TTY government-mandated 9-1-1 access hardware/software upgrades and implementation, mergers/buyouts (national providers reduced from six to four, along with regional mergers also), Communications Assistance for Law Enforcement Act requirements, spectrum auctions, growth in consumer use of wireless data devices, and certainly not least, wireless number portability and pooling.

Utilizing the much-needed resources that the NENA DOT project was able to draw from, NENA was able to participate, and serve as lead where appropriate, across the necessary broad range of entities (telecommunications industry, federal government agencies and departments along with state/local government/emergency services authorities, 9-1-1 community, and many others) to not only advance wireless E9-1-1 implementations and access methods, but also eliminate or minimize any negative effects from the many other changes going on simultaneously within the wireless industry and others.

Within months from the start of the NENA DOT project and the available resources it provided, NENA was able to restructure its operational committee structure so that both operational and technical standards and other informational documents could be created, which provided considerable guidance to PSAPs as they considered and began the extensive planning, development, implementation and ongoing operational/technical work necessary to provide wireless E9-1-1 Phase I and II throughout much of the country.

While the NENA DOT project has been a significant contribution to the widespread rollouts of both Phase I and II, along with ensuring that wireless 9-1-1 access continues correctly when major technical and operational changes have happened within the wireless industry, there

[4] Estimate calculated from NENA DOT project wireless implementation percentages and CTIA 9-1-1 call volume estimates, both of which are included elsewhere in this report. The range is offered because of a degree of uncertainty over phase II capable handset penetration among some providers.

[5] CTIA market survey reports.

[6] NENA DOT wireless E9-1-1 implementation tracking and FCC wireless carrier 9-1-1 quarterly/semi-annual reports.

remains work to do. More than 50% of the counties[7], in the U.S., predominately rural, remain without Phase II, and 25% remain without Phase I. Wireless industry technological and operational changes of significance continue, pointing to the ongoing need to continue ensuring correct 9-1-1 access. The sharply increasing general public use of wireless text devices[8] and the significant value and use of such devices in the deaf and hard-of-hearing community, demonstrate the need to substantially improve the existing 9-1-1 networks in use across the country.

Recent months have also shown escalating marketing among younger age groups (particularly 8-12 years of age) by a number of entities within the wireless industry and it is increasingly important that various educational processes be developed to be sure that youth's wireless 9-1-1 access when needed in emergencies, is dealt with appropriately.

Statistics

Wireless 9-1-1 Progress:[9]

The United States has 6,153 primary and secondary PSAPs and 3135 Counties which include parishes, independent cities, boroughs and Census areas. Based on NENA's preliminary assessment of the most recent FCC quarterly filings (May, 2006):

- 81.0% of 6153 PSAPs have some Phase I
- 61.7% of 6153 PSAPs have some Phase II
- 71.8% of 3135 Counties have some Phase I
- 47.3% of 3135 Counties have some Phase II
- 86.0% of Population have some Phase I
- 73.5% of Population have some Phase II

Prior to the start of NENA DOT project wireless E9-1-1 implementation tracking by county/PSAP, there were a handful of PSAPs in a few places in the country involved in Phase II implementations, basically termed trials, and there were approximately 1200 PSAPs having implemented Phase I with at least one provider. By early 2003, 37% of PSAPs had implemented Phase I with at least one provider and 9% Phase II.[10]

At the end of 2001, there were an estimated 128,374,512 subscribers in the U.S. By the end of 2005, there were 207,896,198.[11]

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[7] NENA DOT wireless E9-1-1 implementation tracking

[8] SMS traffic more than doubles from December 2003 (2 billion messages per month in U.S.) to 4.7 billion per month in December 2004, according the FCC 2005 annual CMRS competition report.

[9] NENA DOT project wireless implementation statistics as of March 1, 2006

[10] FCC wireless carrier quarterly/semi-annual reports. T-Mobile, formerly Voice Stream, began mandated semi-annual wireless Phase I and II status reports in 2000, while the other national providers began in early 2002. Tier II providers (defined as regional providers with more than 500,000 subscribers in 2001) began mandated quarterly reporting in late 2002.

[11] CTIA 2005 market survey

Wireless 9-1-1 call volume in 2001 was an estimated 56,879,775 while in 2005 it was an estimated 82 million.[12]

NENA educational, operational and technical guidance

NENA DOT project enabled resources to be assigned to assist in development of various NENA educational material and courses, along with valuable operational/technical standards and informational documents to help correctly expedite the rollout of Phase I and II across the country. Also enabled was other work to help insure that wireless 9-1-1 worked properly as wireless industry technological/operational changes were made.

Education

NENA constantly was striving to be creative so as to reach more publics and to be meaningful at the same time in its educational approaches, whether they involved PSAPs and 9-1-1 governing entities, other government agencies, telecommunications industry and, of increasing importance, the public throughout the four year NENA DOT project.

Initially, the project specifically included a video package to help proceed with Phase I and II implementations, however, it expanded well beyond that, as NENA courses were developed, special critical issues forums were held, various staff members presented at events throughout the country, articles were written for print media and web distribution (an increasing educational tool as the project proceeded at the same time as web usage escalated), special packages were developed for wireless providers and others to educate staff and distribute to consumers, and individual one-to-one assistance was provided, primarily via phone or email.

Many NENA courses, developed under the auspices of the Education Advisory Board during the four years of the NENA DOT project, were either devoted exclusively to Wireless E9-1-1 or were updated and modified to include curriculum about wireless implementation. NENA estimates that over the 54-month duration of the project, that over 4,000 9-1-1 professionals and others in public safety attended these NENA courses. Since 2003, the most well attended NENA course has been the Introduction to Wireless for PSAPs course, with over 2,000 estimated to have attended. Courses included:

- **Introduction to Wireless for PSAPs**

This class focused on wireless 9-1-1 related issues that affect PSAPs. Beginning with Phase 0 and working through Phase II deployment this course was presented at an introductory and easy to understand level, targeted to the non-technical members of PSAPs and the 9-1-1 community at large. This course provided a straightforward approach to understanding more of the intricacies of wireless 9-1-1 technologies.

[12] CTIA annual market surveys and wireless 9-1-1 estimates.

- **Understanding GIS for the PSAP**

Geographic Information Systems technology is increasingly important in 9-1-1 centers around the nation. Wireless Phase I and Phase II implementations are pushing many call centers to become more aware of this technology. Being able to plot the location of a wireless, or wireline caller, on a map has tremendous benefits in emergency operations. This course demonstrated what GIS is; why GIS is needed; how to acquire, correct, and maintain your GIS data; and how to develop, maintain, and fund a GIS.

- **Grant Management for PSAPs: From Acquisition to Maintenance**

With funding to implement Phase I and/or Phase II becoming an important concern locally, grant funding has become a critical financial supplement for PSAP operations. Grant funding opportunities and awards for such programmatic areas as homeland security and emerging technology continue to increase, but how can 9-1-1 professionals locate grant opportunities and create successful grant applications? This one-day course was designed to give participants an overview to the entire grant management process. It offered participants the tools and strategies to maximize grant-funding opportunities for 9-1-1 centers through best practices and sample sections of a successful grant application.

- **9-1-1 Center Consolidation**

As state/regional/local authorities examined the various aspects of implementing wireless 9-1-1 Phase I and II, increased attention was given to PSAP consolidation. Designed to assist the PSAP manager in understanding the often difficult and demanding process of considering consolidating multiple PSAPs and written from the perspective and experiences of former PSAP managers, the course emphasized those planning steps necessary to overcome doubt, opposition, and obstacles to successful consolidation. Topics of discussion included the reasons for consolidation, assessing existing conditions, determining a consolidated center's needs, the goals of consolidation, and project planning.

- **Introduction to VoIP for PSAPs**

During the last two years of the NENA DOT project, Voice over Internet Protocol (VoIP - including wireless VoIP) received considerable attention. The need for its 9-1-1 access plus the need to have next generation PSAPs capable of handling additional devices, such as wireless text devices, led to the development of two new courses: this one and an Advanced VoIP course. This course focuses on the impact that Voice over Internet Protocol (VoIP) is having on the 9-1-1 community. This new wave of technology is sweeping the world, and with it comes a whole new realm of issues and problems for 9-1-1 centers and emergency service providers. VoIP is changing everything about how calls for emergency services are originated, routed, and delivered to PSAPs. This course examines issues such as the traditional 9-1-1 model, caller location, caller identity, networking infrastructure, threat-risk assessments, and a variety of other interrelated issues. The objective of this course is to help individuals objectively evaluate the impact that VoIP will have on their 9-1-1 operations, envision a proactive approach to resolving issues, and plan for the inevitable.

- **Advanced VoIP**

Providing additional technical depth, this course examines IP technology, voice networking, migratory (i2) and long term (i3) solutions, NG E9-1-1 and more. The objective of this course is to help individuals evaluate the impact that VoIP will have on their 9-1-1 operations, and to help them further plan a proactive approach to resolving these issues while preparing for inevitable changes.

- **Wireless/VoIP Public Education**

This course provides the "simplified" issues with wireless and VoIP that the public need to understand. Messages that need to go out to the public, our legislators and elected officials are reviewed. Specific examples are discussed describing successful public education campaigns and ideas for getting these messages to the public. Without public education, these technologies and solutions will never be completely successful!

Another avenue of education is the NENA Critical Issues Forum. Those held during the NENA DOT project included one reaching representatives from 22 states on the topic of Phase I and II implementation. Current guidance materials and presentations were provided, along with bringing in representatives from the various appropriate wireless providers and vendors involved in the implementation process. Three CIF's focused on GIS issues as GIS use was becoming increasingly important for many PSAPs considering implementation, particularly with Phase II.

Throughout the four years of the NENA DOT project, a major benefit was having appropriate staff members involved in various technical, operational and policy issues and work, while also using the same personnel for providing valuable information from that work to the PSAP community, via not only NENA's annual conferences, but other organizations' conferences, along with regional/state chapter conferences and meetings. With the increasingly rapid identification of issues followed by preparing written solutions, standards and other documents, it was of value that the appropriate people be given current and accurate knowledge.

Also becoming of increasing importance during the four years was the need to educate the telecommunications industry and others regarding 9-1-1, as a means to expedite wireless E9-1-1 deployments and be sure that other changes in that industry were not negatively impacting such access. One of the avenues to accomplish this was to attend, actively participate and offer presentations at various telecommunications-related conferences and meetings, beyond the more traditional 9-1-1 related ones. This approach was another benefit from the NENA DOT project.

While written articles in various publications, including NENA News and ENP Magazine, were of value, it became increasingly apparent that providing articles and other dissemination methods via the web were also of increasing value, primarily because of timeliness.

Two unique consumer education projects that were directly created within the NENA DOT project involved wireless Phase II and wireless number portability.

The first, addressing wireless number portability (WNP, which will be more clearly explained in the "Telecommunications industry involvement" section of this report), involved a combined group of PSAP representatives and industry people (some not normally involved in 9-1-1 topics but more involved in the complex WNP issues). They basically developed a package to be used by wireless providers for educating their sales and marketing staff regarding WNP and its 9-1-1 implications along with consumer education for those customers involved in porting (changing providers and keeping phone number). Without any mandate, these materials were posted on wireless providers' web sites and voluntarily distributed to consumers, addressing the 9-1-1 call back limitations during the multiple days of the porting process.

Following the success of this program, NENA public education committee members and wireless industry representatives met, utilizing NENA DOT project resources, and developed a Phase II consumer education package. This included providing materials to consumers (particularly as they bought Phase II capable handsets) regarding what that meant to them for 9-1-1 access and its limitations. Also included were materials for wireless provider web sites and for training of marketing and sales associates, including local ones, national call center ones and others. In addition to increasing consumer awareness regarding location (and call back number) not always being provided with a wireless 9-1-1 call, the materials addressed the need to not continue driving while accessing 9-1-1 and to not use the handset auto-dial one-button feature for 9-1-1 access. This was another way to minimize the noticeable problem of inadvertent calling of 9-1-1 via wireless phones. Another way used by NENA, with the resources of the NENA DOT project, was to work with manufacturers so that this feature was not pre-programmed prior to marketing/selling handsets.

Less visible to many were the countless direct phone calls to NENA staff involved in the NENA DOT project, from PSAPs, wireless providers and vendors, and many others throughout the four years, seeking various levels of assistance and guidance.

Operations

With the assistance of resources (including additional staff), NENA was able to restructure its operations committee in early 2003. Prior to this time, most formalized NENA documents, such as standards and informational documents were created within the technical structure. However, particularly because of wireless 9-1-1 needs, including implementation and ongoing operational needs, it was apparent that more than less-formalized white papers and such were essential with an operational focus.

In the months following that reorganization, there was considerable output, including step-by-step operational guidance to assist PSAPs in implementing Phase I and II, plus several other standards and related documents which provided valuable assistance for the receiving and processing of wireless 9-1-1 calls. These standards and Operational Information Documents (OIDs) were created under a formalized process which insured input and review by those actively involved in other NENA committee work, NENA membership in general and others.

The NENA DOT project and its resources were an important component in having these documents created and available in a timely and useful fashion. The list of documents and a brief summary is as follows:

- **NENA TTY Training Operational Standard (52-001)**

With an estimated 54 million people in the United States who have disabilities, over 28 million have hearing loss or speech impairment and may utilize TTYs (increasingly digital wireless ones) for telecommunications. This "NENA TTY Training Operational Standards Document" is a tool for PSAPs to use in the development of TTY training programs. It outlines the recommended elements to be contained within a training program to assist PSAPs with compliance of Title II of the Americans with Disabilities Act.

- **NENA TTY Call Taker Proficiency and Quality Assurance E9-1-1 Operational Standard/Model Recommendation(52-003)**

The purpose of this document is to provide recommendations toward the implementation of a comprehensive Quality Assurance Program which includes training of call takers, conducting random, unannounced test calls, completing documentation of training and test calls, and conducting remediation activities to address identified deficiencies and equipment malfunctions.

****Wireless digital TTYs.** During the first few years of the NENA DOT project, the wireless industry was implementing compliance changes to an FCC mandate requiring wireless digital TTYs to work correctly when accessing 9-1-1. Those changes increased the importance of these testing standards and recommendations. The U.S. Department of Justice has indicated that PSAPs should test their equipment and call takers to ensure compliance with the ADA's requirements for direct and equal access. Utilizing this document is a step toward compliance.

- **NENA Guidelines for Minimum Response to Wireless 9-1-1 Calls (56-001)**

This document was developed to serve as a model standard operating procedure for those Public Safety Answering Points (PSAPs) that receive wireless 9-1-1 calls.

To facilitate the handling of wireless 9-1-1 calls, the following information is provided:
• A description of the phases of wireless 9-1-1 implementation and the type of information that is delivered to the PSAP with each Phase.
• Definition of the types of wireless disconnected or silent 9-1-1 calls that a call-taker may encounter.
• Recommended action when a call taker receives a wireless silent 9-1-1 call or the wireless caller is disconnected.
• Guidelines for the use of discretion when a wireless silent or disconnected call is encountered.
• Recommended action in the event an emergency service response is required.

Since local options are varied, this document also provides sections to describe the appropriate wireless call routing configuration, wireless trunking solution, wireless service providers' emergency contact information and it facilitates access to subscriber information for ported and

pooled telephone numbers along with including the procedure to obtain the contact information for roaming wireless subscribers

- **NENA Standard for NORAD Notification: Airborne Events (56-002)**

In another NENA and federal government participatory project, NENA and the North American Aerospace Defense Command (NORAD) authorities worked together to develop procedures for Public Safety Answering Points (PSAPs) to notify NORAD of certain air events that may require their response.

Following that and after the NENA operational restructure, the procedures became part of a national operational standard. Recognizing that 9-1-1 call centers are likely to receive the first notification of air events that may threaten national security, NORAD proposed this procedure in 2002. A Memorandum of Agreement (MOA) was developed between NORAD, NENA and NASNA by year's end. This procedure was included as an attachment to the MOA, and is being reissued in NENA Standard/Operational Recommendation format.

This procedure is intended to:
• Provide guidance to 9-1-1 call takers in the appropriate handling of calls involving reports of airborne events that may threaten national security.
• Reduce the time between the onset of an event and notification to NORAD.
• Enhance the ability of NORAD to appropriately and effectively respond to critical events.
It is recommended that certain information be collected in the following circumstances:
• Emergency calls from airborne aircraft
• Reports of a suspicious airborne object or aircraft
• Reports of a recent or in progress aircraft theft

- **TTY/TDD Communications Standard Operating Procedure Model Recommendation (56-004)**

This document has been developed to serve as a model standard operating procedure for handling TTY/TDD Communication (including digital wireless TTY device access) within Public Safety Answering Points (PSAPs). To provide uniformity and consistency in the handling of these calls, the following call-taking standards are recommended:
• Telecommunicator training
• Identification of TTY/TDD calls
• TTY/TDD equipment and operation
• Testing
• Call handling process
In addition, this document provides a description of the variations in communicating with the hearing and speech impaired, such as the acoustic coupler mode, Voice Carry Over, Hearing Carry Over and Relay Service Calls.

- **NENA Wireless E9-1-1 Overflow, Default and Diverse Routing Operational Standard (57-001)**

The intent of this standard is to provide operational guidance and recommendations regarding the identified call routing scenarios as they relate to calls processed between the mobile switching office (MSC) and the 9-1-1 selective router (SR).

Implementation of these recommendations fosters consistent operational standards across wireless E9-1-1 systems. In addition this document establishes definitions for the call routing scenarios to foster a common understanding and use of terms between PSAPs and Wireless Service Providers as the wireless deployment is being planned.

The wireless overflow, default, alternate and diverse routing operational standards' recommendations are centered on the following premises:
• Overflow, alternate, default and diverse routing should be reviewed with the WSP during the planning and implementation of wireless E9-1-1 service.
• Wireless 9-1-1 calls should be routed within the 9-1-1 network infrastructure.
• Wireless 9-1-1 calls should be routed via dedicated 9-1-1 call paths.
• Wireless 9-1-1 calls should not be routed to ten-digit administrative numbers.
• Wireless 9-1-1 calls routed to other than the serving PSAP should be done on a pre-planned basis using appropriate communications infrastructure, SOP's, mapping and associated resources. Appropriate agreements with the serving PSAP must be in place to ensure proper notification, routing, data integrity and call handling.

- **A Public Safety Answering Point Managers' Guide to Geographic Information Technology (White Paper)**

This paper includes information on how to best deal with wireless information coming into the Public Safety Answering Point. Any PSAP that is now, or will be, receiving wireless calls (primarily Phase II) will find this paper useful. This focus of this paper is how to best utilize Geographic Information Systems in dealing with wireless 9-1-1 calls in the PSAP.
A NENA Critical Issues Forum identified key concerns of GIS technology in the PSAP as being data quality, integration, and data maintenance. Addressing these issues will become increasingly important as the number of wireless devices making 9-1-1 requests continues to increase. These issues, and possible solutions for PSAPs, are addressed in this white paper.

- **NENA IP Capable PSAP Features and Capabilities Standard (58-001)**

This document contains a list of capabilities or features that need to be supported in a public safety answering point (PSAP) using IP based 9-1-1 equipment and software. These capabilities and features should be considered a minimum level of functionality, developed in an open architecture environment that will allow interoperability at all levels of the 9-1-1 network, regardless of vendor. The open architecture will allow PSAPs to receive call-related data directly from multiple data sources such as telematics service providers or Internet based telephone service providers, rather than being restricted to access to a single database (ALI) as in the current 9-1-1 system. This should reduce overall costs and increase efficiency.

- **NENA OID - A Study Focused on Processing Silent or Hang-Up 9-1-1 Calls for Service (56-501)**

This document encourages agencies to build cooperative working relationships with wireless carriers, identify 24/7/365 contacts points within wireless carrier organizations for customer information (i.e., security), and work with wireless carriers' to address their concerns regarding confidentiality and liability.

Further, this document suggests that NENA (either at the state or national level) provide agencies support and guidance in designing an appropriate procedure that meets the needs of both public safety and wireless carriers.

Finally, wireless carriers – particularly those providing Phase I and/or Phase II location services - should provide each PSAP in their service area with a toll free (preferably) emergency contact number for public safety agencies to call to obtain emergency customer information in response to a silent, hang-up or abandoned E/9-1-1 call for service, or any event where a caller has requested assistance via a wireless device vis-à-vis a wireline one.

- **NENA Wireless Phase I and II Features and Functions OID (57-501)**

The purpose of this Operations Issues Document is to define how E9-1-1 Phase I and Phase II should work in a best practice operational environment, given the current technology limitations.

The reason to implement is to allow PSAPs to operate more efficiently and effectively by receiving standard data formats and common data from all wireline and wireless carriers providing E9-1-1 Phase I and II service.

- **NENA Wireless Phase I/II Planning and Implementation Checklist and Modules (57-502)**

The Wireless E9-1-1 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

This document is intended to act as a best practice for the deployment of wireless E9-1-1 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.

Wireless Phase I or Phase II 9-1-1 deployments can be completed with minimal difficulty when standard processes are understood and employed. The document also includes a wireless implementation checklist to follow during the process.

Technical

While technical standard and information document creation was already an in-place process prior to the NENA DOT project, the project did permit additional resource time to be applied in order to expedite certain work products.

- **NENA Standard for the Implementation of the Wireless Emergency Service Protocol E2 Interface (05-001)**

This "NENA Standard for the Implementation of the Wireless Emergency Service Protocol E2 Interface" document provides explicit protocols and parameters for interoperable operation of the E2 interface over TCP/IP. [1]This interface is between the MPC/GMLC and the EMSE as defined in TR45.2's TIA/EIA/J-STD-036. This document defines the methods that MPC/GMLC and ESME use to interact, allowing for the concept of geographically redundant nodes and the inherent link management.

The use of this standard by equipment vendors will facilitate the implementation of the E2 interface between the wireless network and an ESME. It assures that vendors implement the parameters, TCAP, TCP/IP and link management in a consistent manner which will aide in the interoperability of the network elements as each vendor and their associated carriers roll out Wireless Phase II. This document specifies implementation details not specified in TIA/EIA/J-STD-036-A down to explicit elements so that there can be no confusion regarding how parameters are to be implemented.

- **NENA Standards for E9-1-1 Call Congestion Management (03-006)**

This document provides a framework for consideration of the various factors impacting the management of call congestion and traffic engineering for E9-1-1 networks. A network reference model is provided for use in referring to generic E9-1-1 network entities. This is followed by a section that outlines generally accepted industry practices for traffic engineering for E9-1-1 networks.

This document focuses on the use of trunking capacity between network entities as the primary means of managing call congestion. It is acknowledged that enhanced methods of managing call congestion may be developed that leverage new intelligent network capabilities. It is also

acknowledged that other points within the various networks involved in delivery of E9-1-1 calls have an impact on the level of service and call volumes supported, however, these potential enhancements and other network elements are not within the scope of this version of this document.

This Standard is intended to provide a guideline for all telecommunications carriers (including local exchange carriers (LECs), competitive local exchange carriers (CLECs), commercial mobile radio services (CMRS), satellite carriers, etc), E9-1-1 network providers, and public safety agencies for how to manage call congestion in an overall E9-1-1 network.

This document is intended to provide greater parity between any type of E9-1-1 call, regardless of the source of its origination (wireless, traditional landline, VoIP, PBX/MLTS etc.)

- **02-010 NENA Standard Formats & Protocols for ALI Data Exchange, ALI Response & GIS Mapping (02-010)**

This document was updated to include recommended ALI field usage and content structure for wireless E9-1-1 ALI data in general and for wireless provider interaction with wireline provider in a competitive portability environment.

- **NENA Data Standards for Local Exchange Carriers, ALI Service Providers & 9-1-1 Jurisdictions (02-011)**

This document sets forth NENA standards for all Service Providers involved in providing dial tone (or wireless equivalent access) to end users whether or not they are the 9-1-1 Database Management System Provider (DBMSP) or a SP in an Enhanced 9-1-1 area. It includes Database Maintenance, Quality measurements, INP, LNP and Number Pooling standards to be utilized for any 9-1-1 system that provides information for data display. It defines measurements that support meaningful computations to allow for a better understanding of database quality and timeliness of database updates.

This document defines the provisioning requirements for E9-1-1 data integrity, content, and call delivery regardless of dial tone provider. It is the goal of these standards to support current and future development consistent with the concept of “One Nation, One Number”. It is assumed that Federal, State or Local legislation will supersede these standards.

During the NENA DOT project months some of the revisions to the data standards (02-010 and 02-011) included

Section 22 Standards for Local Number Portability to include General LNP and WNP Standards, Resolution of Failed Migrates, Resolution of Stranded Unlock Records, Wireline/Wireless Porting
Section 26 Global Changes to NENA Company ID, including wireless information
Section 28 Determining Ownership of a Telephone Number
Section 29 Wireless No Record Found Reporting Process

- **NENA Company ID Registration Service Technical Information Documents**

This document details the Company ID program and provides instructions for companies, including wireless carriers, to register their company identification. This document is posted on NENA's web page, www.nena.org and available to all who can access the site.

- **PSAP Call Back to All 9-1-1 Callers, Combating Wireless E9-1-1 Fraud and Mobile Emergency Service (E9-1-1M) (03-504)**

This document contains standards requirements for providing the PSAP with a working callback number to all wireless phones that call 9-1-1. It brings with it the solution to a number of other open issues.

E9-1-1M transforms E9-1-1 from a fixed network service to a mobile network service. It opens the door to the delivery new mobile emergency services through new access technologies such as voice over IP, 3G wireless, WiFI/WiMax and NGN Convergence. E9-1-1M also provides new capabilities for the PSAP and wireless service provider to deal pro-actively with fraudulent 9-1-1 calling behavior. While these benefits are difficult to quantify at this stage of development, they can't be overlooked.

This document contains standards requirements for the following capabilities.
• Enable a PSAP to call back all phones, including wired, wireless, mobile or fixed phones, used to originate a 9-1-1 call.
• Combat fraudulent 9-1-1 calling from wireless and mobile phones.
• Manage mobility for all mobile phones used to call 9-1-1 or invoke any emergency service.
• Introduce new services to improve mobile emergency communication between a PSAP and other PSAPs, the public, responders and other agencies.
These capabilities are applicable for all access networks, wireless or landline. They are independent of access network technology and should be forward migrate able as they are applied to evolving technical standards.

This document is issued in response to a number of issues raised within the NENA Technical and Operations Committees and the Emergency Services Interconnection Forum related to providing the equivalent and most effective 9-1-1 service for fixed, mobile, wireless and landline phones [1, 23]. These concerns, in general, are for the following.
1. Service to phones with a mobile, portable, international, private or no callback number (non-subscriber initialized, telematics units, and international roamers).
2. Reduce the potential for 9-1-1 fraud from wireless and mobile phones.
3. Take fullest advantage of existing standards, as well as the new network elements and interfaces recommended in this Technical Issues Document for callback and to combat fraud, by introducing new mobile emergency services.

Telecommunications industry involvement

While NENA was actively involved in some telecommunications industry groups, including those developing standards or doing similar operations/technical work, prior to the project, the active involvement increased considerably because of the NENA DOT project resources available.

Such involvement helped hasten correct implementations of phase I and II at PSAPs, while it also eliminated or minimized possible negative 9-1-1 effects for other technological and operational changes going on within the industry beyond 9-1-1. While this latter involved considerable work, its results were sometimes not noticed because there were little to no outstanding negative 9-1-1 effects when changes occurred.

One of the major industry changes was wireless number portability (WNP), which began in the top 100 metropolitan areas of the U.S. in late 2003 and in much of the remainder of the country in spring of 2004. WNP allows customers to change providers while retaining their existing phone number, regardless of whether its use with their former provider was wireline, wireless or (as also quietly began in 2003) VoIP.

In the beginning stages of the needed technical, operational and policy work to make WNP happen, it was viewed as something that would involve very large numbers quickly (possibly several million during the winter holiday season of 2003) and could/would cause significant problems regarding call delivery and receipt.

The large numbers did not materialize as quickly as some estimates. Just over 11 million wireless subscribers ported to another provider in the first 16 months, with an average over 700,000 per month continuing through the spring of 2005. Also of significance has been the wireline to wireless porting, with those being about 76,000 per month in the first half of 2004 climbing to about 99,000 monthly in the latter half of the year.[13] Of importance regarding these increasing numbers is the need to be sure 9-1-1 access functions correctly during and after the porting process and the need for wireless E9-1-1 phase II as more and more consumers monthly move to wireless phone access as their primary and/or main communications access.

While WNP technical and operational processes were being developed within the telecommunications industry, NENA, utilizing the NENA DOT project resources, was able to extend its active involvement appropriately within industry groups.

These groups included:

North American Numbering Council (NANC), a federal advisory committee created by the FCC, for oversight and industry recommendations regarding various number resource topics.

Local Number Portability Administration Working Group (LNPA-WG), created by NANC as the main telecommunications entity to develop number portability (and number pooling) processes

[13] FCC 2005 annual CMRS competition market survey report.

and guidelines, along with doing the key work regarding various involved issues. This group is freely open to any telecom industry participation along with other interested groups, such as NENA.

Specifically for WNP, NANC initially created a WNP subcommittee, which was to create initial recommendations to NANC. Following the WNPSC work, the Wireless Number Portability Operations team (WNPO) was created and worked closely with the LNPA-WG for its several months of existence, with it in recent months merging into the LNPA-WG. Also to assist in its work, the Wireless Testing subcommittee (WTSC) was created and continues to function today.

Independently but working as much as possible in coordination with the LNPA-WG, was the National Number Portability Operations team (NNPO). In the mid-90s, several state/regional groups were created regarding number portability and pooling issues and work. These eventually all merged, forming the NNPO, which did finally disband in recent months also.

Within the Alliance for Telecommunications Industry Solutions (ATIS), key groups with NENA active participation and assistance were the Ordering and Billing Forum (OBF) which primarily works on intercarrier standardized documents for various tasks, and the Industry Numbering Committee (INC), with a key task of establishing guidelines for number administration to and for the telecommunications industry. Another was the Network Interconnection Interoperability Forum (NIIF)

As part of its efforts to insure correct 9-1-1 access in these new numbering changes (portability and pooling, which is the assigning of numbers to providers in lesser amounts than a code/prefix, in order to conserve numbering resources), NENA created a special WNP subcommittee, jointly under both wireless and data technical committees. With approximately 125 members, it was one of the largest technical groups ever created within NENA at the time (later, NENA's VoIP and subsequent NG E9-1-1 work would involve even more). Comprised of a wide range of participants beyond normal (at least for NENA, which traditionally had relied on 9-1-1 technical experts), its membership ranged from wireless industry technical experts including engineers (with little to no 9-1-1 expertise) to regulatory/policy wireless legal experts.

It identified and tracked approximately 30 known issues, which were then worked and resolved within various industry groups as listed, with NENA being an active participant in all such.

Key issues included:

- Industry 9-1-1 testing prior to WNP implementation. Testing scripts and scenarios were developed within the WTSC and approved by the WNPO and others. A number of tests, each involving multiple providers and PSAPs, were conducted across the nation. In addition to insuring correct 9-1-1 access, these also helped in identifying any PSAP operational issues and concerns, correcting where necessary and further educating the PSAP community. In one small provider testing, a switch setting issue was discovered involving a vendor's wireless switches used across the country. If left unidentified and unfixed, this could have lead to wireless 9-1-1 calls being routed to totally incorrect numbers (business/residential) after implementation, however, after identified and fix determined, this was publicized and therefore corrected, throughout the industry.

- MIN/MDN separation. Prior to WNP and pooling, the mobile identification number (MIN) for a wireless handset and the mobile dialable number (MDN, the handset owner's phone number) were the same. To implement WNP and pooling, the industry technical solution involved separating these into two separate numbers. It was important that the MIN (which could not be called back) did not appear as the callback number in wireless E9-1-1 phase I and II, instead, the MDN should always be provided. While the customer's network provider would always do so, it was initially unclear regarding roaming and work was done in the various industry groups to insure that roaming networks also complied and followed the correct process for wireless 9-1-1. Also, since MINs were no longer part of North American Numbering Plan (NANP) resources, since, even though they followed the same 10 digit structure, they were used more as a handset ID, industry group work by NENA helped establish that the 911 numbers would not be used in either the first three or second three places of that 10 digit number, another step to be sure there were no negative side effects to the upcoming change.
- 9-1-1 database processing changes. Working within the various industry groups (predominately OBF for the actual industry written guidelines), NENA helped identify appropriate field values within porting intercarrier documents so that 9-1-1 data processes could be done properly. The correct 9-1-1 data processes themselves were identified and established within NENA committee work and their appropriate data standards, which were revised, approved and publicly distributed. This work helped insure that incorrect location data did not appear at PSAPs as part of a wireless 9-1-1 call.

Also worked within various industry groups, predominately INC, during the NENA DOT project, was the use and administration of pANIs (pseudo Automatic Number Identifiers) used for routing, delivery and display of Phase I and II 9-1-1 calls at PSAPs. The use of pANIs as part of wireless E9-1-1 call processing is necessary primarily because of roaming and callers' phone numbers can therefore be from any area code in the country. In general, traditional PSAPs and existing 9-1-1 networks/databases are not capable of delivery of 9-1-1 callback numbers which may involve area codes from anywhere in the country, as traditional ANI. NENA's work in this area included having INC set aside number ranges with NANP guidelines, specifically for pANIs and to have these be non-dialable.

Created jointly in early 2002 by NENA and ATIS, the Emergency Services Interconnection Forum (ESIF), in its first several months was primarily working various technical interconnection issues involving wireless 9-1-1 and some operational ones. The NENA DOT project have helped insure that NENA is actively involved, including representatives attending all quarterly multiple-day face-to-face meetings, in this wireless 9-1-1 work.

Key issues included:

- Overflow of 9-1-1 calls to 7/10 digit PSAP lines when MSC to SR trunks were busy. Resolution stated "ESIF recommends against overflow routing of 9-1-1 calls to 10-digit numbers in an overflow condition and will publish an information bulletin." This was also reiterated in a NENA operational standard (57-001).
- Phase II Location Reliability Factor. Resolution stated "ESIF recommends that uncertainty be delivered to the PSAP. Confidence can be optionally delivered across the E2 interface."

- PSAP Documentation to Satisfy the Richardson Order Verification Requirement. Resolution of this issue included publication of a PSAP readiness checklist, largely developed by NENA staff members, with the appropriate requirements, as agreed to by ESIF-participating national wireless providers and NENA. This, coupled with the other NENA implementation assisting documents as detailed in "Operations," has helped eliminate confusion and speed up paperwork processing for quicker and smoother phase II implementations.
- Callback Capability to Donated and Prepaid Wireless Handsets. This and other issues raised at ESIF regarding wireless handsets which did not deliver usable callback numbers in Phase I and II environments were closed with the release of NENA TID 03-504, details provided earlier in this report.
- Phase II Test Methodology. This addressed the need for a standardized testing methodology recommendation and was closed with the development and approval of an implementation test plan. (While this addresses technical standardization, it does not address the policy issues regarding location accuracy, which remain unresolved at the national level.) Separate and similar work has been done within ESIF regarding development of a standardized wireless Enhanced 911 call and data delivery test mechanism. That technical testing plan is now in the review and approval process within ESIF.
- Ongoing maintenance testing after Phase II implementation. This issue continues to be worked within ESIF.
- Standard text messages. This issue addresses the standardization of various text error messages, primarily in delivery of a wireless 9-1-1 call in a local Phase II environment. Recommended standardized messages have been approved by ESIF.
- Maintenance Testing – Methodology Recommendations. This issue continues to be worked by ESIF.

The FCC's Network Reliability and Interoperability Council (NRIC VII) took up a number of wireless related issues during late 2004 and 2005, and NENA staff and members took part in much of that work. Most notably were the issues of location accuracy and testing methods for Wireless E9-1-1 Phase II, along with several short term E9-1-1 and PSAP operational matters. These included ALI-related data base structural recommendations, network interface recommendations, and database query timing issues.

The issues and recommendations surrounding accuracy requirements included:

- Recommendations for Accuracy certification and reporting area
    - It was agreed that accuracy shall be certified and reported on a statewide basis after specified deployment levels are attained.
- Recommendations for Certification and Reporting area for carriers operating in rural areas
    - It was agreed that rural carriers will meet accuracy levels attained by Tier 1 and Tier 2 carriers within the rural carrier's coverage areas.
- Recommendations for Compliance Testing
    - Carriers agreed to certify compliance to the FCC at the State level using ESIF/OET based testing methods when Phase II deployment meets defined thresholds.
- Recommendations for Maintenance Testing
    - All parties agreed to maintenance testing concepts with specific methods and procedures, including accuracy verification, to be further defined by ESIF.
- Recommendations for Consolidated Representative Performance Statistics

    - Carriers agreed to provide representative performance characteristics for various topographical areas.
- Recommendations for Access to Compliance & Maintenance Testing Data
    - Carriers agreed to make test data available to the FCC and Public Safety upon request if confidentiality can be maintained.
- Indoor versus Outdoor Location Testing
    - All parties agreed to specified percentages of test calls that must be conducted from indoor locations for compliance and maintenance testing.
- Recommendations for Equipment Used For Location Accuracy
    - It was agreed that test equipment should be typical of equipment used by ordinary customers.
- Recommendations for Confidence and Uncertainty
    - All parties agreed that wireless carriers will provide, and E9-1-1 SSPs shall pass confidence and uncertainty estimates in accordance with standards being developed by ESIF.

Survey of Costs to Complete Phase II

Purpose of Survey

The task to undertake a survey of costs to complete Phase II was a work item added to the Wireless Implementation Project in order to respond to a request of the Government Accountability Office for that survey. The November 2003 GAO report called for an estimate of the equipment needs of PSAPs and county 9-1-1 systems in order to complete wireless Phase II at the national level. The evaluation was to involve contacting state 9-1-1 administrators, state 9-1-1 coordinators, and county 9-1-1 coordinators to assemble information regarding PSAP equipment needs for wireless Phase II.

Methodology

Survey Sample

The survey of counties without Phase II wireless started with a sample size of 1,819 counties when initiated in October 2005 (Table 1). That list was extracted from the Wireless Deployment Profile.

Table 1. Number of Counties without Wireless Phase II, by State

State	Complete	State Funded	State Info.	No Phase II	Funded	Not Funded	
Alabama				32+	7	25+7	
Alaska			X	24			
Arizona			X	13			
Arkansas			X	32			
California		X		42			
Colorado				42	15	27	

Connecticut	**X**			**0**			
Delaware		**X**		**3**			
District of Columbia	**X**			**0**			
Florida		**X**		**19**			
Georgia				**143+**	**44**	**99+4**	
Hawaii		**X**		**3**			
Idaho				**38+**	**5**	**33+3**	
Illinois				**61+**	**35**	**26+9**	
Indiana		**X**		**10**			
Iowa		**X**		**37**			
Kansas				**88**	**50**	**38**	
Kentucky			**X**	**41**			
Louisiana				**55**	**25**	**30**	
Maine	**X**			**0**			
Maryland	**X**			**0**			
Massachusetts	**X**			**0**			
Michigan				**11**	**11**		
Minnesota				**1**	**1**		
Mississippi				**79**	**22**	**57**	
Missouri				**79+**	**8**	**71+3**	
Montana			**X**	**55**			
Nebraska			**X**	**93**			
Nevada				**15+**	**3**	**12+4**	
New Hampshire	**X**			**0**			
New Jersey		**X**		**10**			
New Mexico		**X**		**33**			
New York				**26**	**20**	**6**	
North Carolina				**30**	**22**	**8**	
North Dakota				**1**		**1**	
Ohio				**83**	**37**	**46**	
Oklahoma				**77+**	**24**	**53+17**	
Oregon		**X**		**24**			
Pennsylvania				**56**	**21**	**35**	
Rhode Island	**X**			**0**			
South Carolina				**23**	**14**	**9**	
South Dakota				**62**	**28**	**34**	
Tennessee	**X**			**0**			
Texas				**209+**	**206**	**3**	
Utah				**28**	**10**	**18**	
Vermont	**X**			**0**			
Virginia		**X**		**27**			
Washington		**X**		**4**			
West Virginia		**X**		**29**			
Wisconsin				**61**	**40**	**21**	
Wyoming				**20**	**8**	**12**	
Total				**1819**	**656**	**664+47**	

Survey Design

Early in the Wireless Implementation Project, NENA developed a comprehensive checklist for counties and/or PSAPs to use to assist in the implementation of Phase I and Phase II wireless. In part, the checklists specified what needed to be in place with respect to network, CPE, and mapping systems enhancements. Together, these three components account for most, if not all, quantifiable non-labor costs to implement wireless Phase II.

The survey questions, then, were developed to estimate costs for network, CPE, and mapping. Of added interest were any recurring costs for network and CPE, as differentiated from the one-time fixed cost to implement Phase II.

States with Wireless Phase II

States that have completed Wireless Phase II statewide include the following:

Connecticut
Delaware
District of Columbia
Maine
Maryland
Massachusetts
Minnesota
New Hampshire
Rhode Island
Tennessee
Vermont

Other states have indicated that Wireless Phase II will be completed at some point in the future with state funds that are already available. These include:

California
Florida
Indiana
Iowa
New Jersey
New Mexico
North Dakota
Oregon
Virginia
Washington
West Virginia

There are, therefore, 21 states plus the District of Columbia for which additional funds beyond those already committed are not needed.

Calls to State 9-1-1 and/or Wireless Coordinators.

The work scope called for contacts, by phone, to state 9-1-1 and/or wireless coordinators and to county 9-1-1 coordinators for information regarding estimates to complete Phase II. We initially called state coordinators to see if there was statewide information available. Six states provided cost information for statewide Phase II implementation. These states – Arizona, Arkansas, Kentucky, and Montana, Nebraska, and New Jersey - combined for 244 counties. Twelve other states indicated that they had state funds set aside for the completion of Phase II in their state, and that completion would be in the near term. These 12 states contain 255 counties without Phase II, so the number of required county coordinator surveys was reduced to 1,320.

Current Number of Counties without Wireless Phase II

As time progressed, and as the project team obtained additional information from the survey concerning counties that have already implemented Phase II, the number of counties without wireless Phase II declined from 1,819 to 1,624, which represents the current number of counties as of May 2006 that have yet to implement wireless Phase II (see Table 2). This number is consistent with the Wireless Deployment Profile maintained by NENA as part of the USDOT Wireless Implementation Project.

Table 2. Number of Counties Without Wireless Phase II, by Population Type

STATE	<50K	50-100K	>100K	TOTAL
Alabama	25	1	2	**28**
Alaska	20	3	0	**23**
Arizona	4	2	7	**13**
Arkansas	29	1	0	**30**
California	15	7	12	**34**
Colorado	39	0	3	**42**
Florida	13	3	2	**18**
Georgia	110	12	11	**133**
Hawaii	0	1	2	**3**
Idaho	33	2	1	**36**
Illinois	39	4	5	**48**
Indiana	4	1	1	**6**
Iowa	19	1	1	**21**
Kansas	68	2	0	**70**
Kentucky	18	1	0	**19**
Louisiana	37	7	3	**47**
Minnesota	2	0	0	**2**
Mississippi	64	6	3	**73**
Missouri	69	5	3	**77**
Montana	49	3	1	**53**

Nebraska	89	1	1	**91**
Nevada	13	0	2	**15**
New Jersey	0	0	1	**1**
New Mexico	21	6	1	**28**
New York	6	9	6	**21**
North Carolina	17	9	1	**27**
North Dakota	0	0	0	**0**
Ohio	36	19	26	**81**
Oklahoma	65	8	4	**77**
Oregon	19	2	0	**21**
Pennsylvania	23	10	19	**52**
South Carolina	10	4	5	**19**
South Dakota	54	0	0	**54**
Texas	182	13	12	**207**
Utah	21	0	5	**26**
Virginia	22	0	1	**23**
West Virginia	28	2	0	**30**
Wisconsin	39	11	5	**55**
Wyoming	18	2	0	**20**
TOTALS	**1320**	**158**	**146**	**1624**

Methodology for Cost Estimates

For purposes of this analysis, NENA delineated three types of counties to help in the estimate of costs for wireless Phase II. Previous work by NENA and others has shown that, in general, small rural counties can be characterized as having only one or two PSAPs, with countywide addressing and a limited amount of CPE. Larger counties typically have more PSAPs, more positions per PSAP, and more CPE. Finally, larger cities will usually have still more PSAPs, positions, and CPE.

Using that information, NENA devised three types of counties based on population size – small, medium and large. Population size was selected because it is a data element readily available for all counties, and it correlates well with the size and complexity of emergency telecommunications systems.

Type 1 counties are small rural counties (less than 50,000 population) with network, CPE, and mapping requirements. Type 2 are larger counties with between 50,000 and 100,000 population and slightly higher mapping requirements. Type 3 are counties with greater than 100,000 population. On average these counties have higher costs for network, CPE and mapping.

Findings/Results

The surveys were compiled for each of the three types of counties. 157 completed surveys were available for Type 1 counties, 28 for Type 2 and 23 for Type 3. Total costs for wireless Phase II

were determined by adding together the cost estimates for network, CPE and mapping for each county where the information was available from the surveys.

Table 3 shows the average cost for network, CPE and mapping for all counties in each type. These costs are based on the actual costs reported by counties in the survey. Due to the relatively small sample size of responses to each question, the results are presented in summary form only – for network, CPE and mapping – by type based on population size.

Table 3. Total Average Cost of Equipment by Type of County

	Population	Total Average Cost
Type 1	<50,000	183K
Type 2	50,000 – 100,000	278K
Type 3	>100,000	565K

Six states provided estimates of costs for statewide implementation of wireless Phase II. These are as follows:

Arizona – $23,000,000 (cost recovery state)
Arkansas - $2,000,000
Kentucky - $8,000,000
Montana - $10,000,000
Nebraska - $3,600,000
New Jersey - $28,000,000

	Number of Counties	Cost Per County	Total Cost
Type 1	980	183K	$179,340,000
Type 2	128	278K	35,584,000
Type 3	120	565K	67,800,000
Total	1,228		$282,724,000

Adding the cost information from the survey results to the estimates from the six states, less Arizona since it is a cost recovery state, the combined total is $334,324,000.

Discussion

These are, at best, estimates of costs for completion of Phase II wireless. They are, however, very plausible in light of known costs to implement Phase II wireless combined with the estimate of costs from the surveys and from state 9-1-1 and wireless coordinators in the six states from which that information was obtained.

One additional consideration that became obvious from the survey of state administrators and county 9-1-1 coordinators is that timing of implementation is very much tied to the availability of funding. Many counties that were contacted explained that the sources of funding for Phase II were known and identified (surcharges were most often mentioned as the funding source) and it was a matter of moving forward with implementation. Some of the projected costs, then, may not represent an unfunded need for equipment, but rather are future costs that are both known and for which a funding source has been identified.

Other considerations include the fact that some states such as Ohio have been late in the passage of legislation to reimburse for equipment costs and other costs related to wireless Phase II. Ohio, for example, is rapidly deploying wireless Phase II following passage of its state legislation in late 2005. Every month counties are receiving approval of their wireless Phase II programs (including funding for equipment) from the state 9-1-1 office, and deployment is proceeding at a relatively rapid, albeit late, pace.

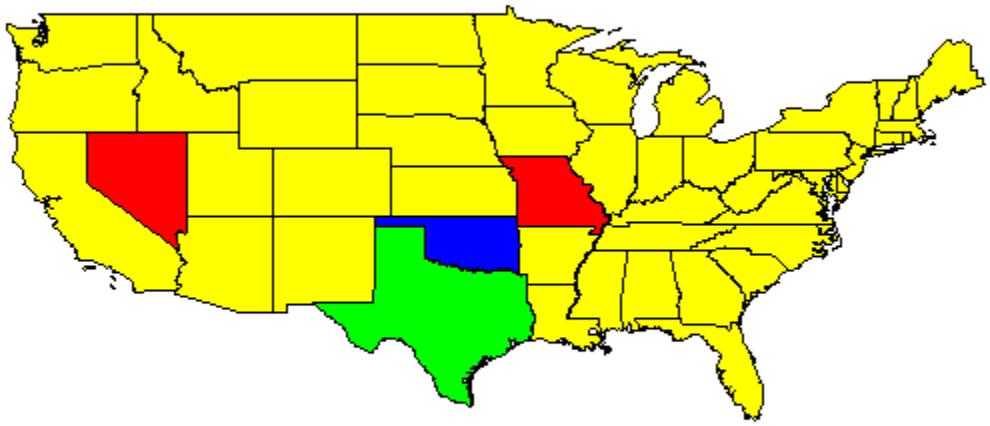
With wireless Phase II deployment now in excess of 50% of counties and PSAPs, but over 75% of population served, the remaining deployment efforts must be focused on rural areas. There, the same constraints that have historically adversely impacted the ability of rural areas to implement Enhanced 9-1-1 will come into play once again. Policy and funding must be directed towards those rural areas, in conjunction with the state 9-1-1 offices where they exist. Where no state 9-1-1 coordination exists, efforts must also focus on formation of state 9-1-1 offices. Without such coordination, wireless 9-1-1 in rural areas will continue to lag behind urban areas.

Appendix 1: Wireless Deployment Profile – Summary Tables

Table A-1.1 Percentage Of Counties With Phase II Cost Recovery Plan

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	100%	Alaska	96%
Arizona	100%	Arkansas	100%
California	100%	Colorado	100%
Connecticut	100%	Delaware	100%
DC	100%	Florida	100%
Georgia	90.86%	Hawaii	100%
Idaho	97.92%	Illinois	100%
Indiana	100%	Iowa	100%
Kansas	100%	Kentucky	100%
Louisiana	100%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	100%	Missouri	0%
Montana	100%	Nebraska	100%
Nevada	13.04%	New Hampshire	100%
New Jersey	100%	New Mexico	100%
New York	100%	North Carolina	100%
North Dakota	100%	Ohio	100%
Oklahoma	52.29%	Oregon	100%
Pennsylvania	100%	Rhode Island	100%
South Carolina	100%	South Dakota	100%
Tennessee	100%	Texas	37.99%
Utah	100%	Vermont	100%
Virginia	100%	Washington	100%
West Virginia	100%	Wisconsin	100%
Wyoming	100%		

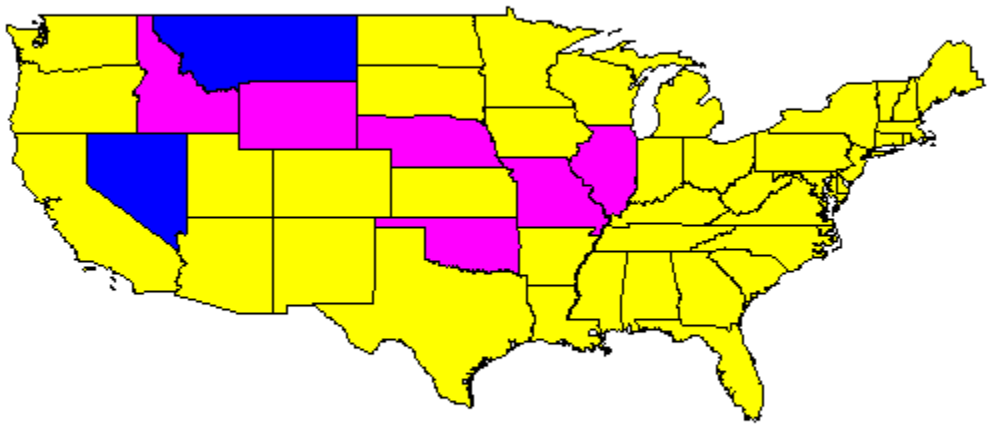
Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Table A-1.2. Percentage Of Counties That Are E9-1-1 Capable

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	95.52%	Alaska	54.17%
Arizona	93.33%	Arkansas	93.33%
California	100%	Colorado	100%
Connecticut	100%	Delaware	100%
DC	100%	Florida	100%
Georgia	85.53%	Hawaii	100%
Idaho	64.44%	Illinois	78.43%
Indiana	96.74%	Iowa	100%
Kansas	83.81%	Kentucky	80.17%
Louisiana	96.83%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	90.24%	Missouri	79.31%
Montana	44.07%	Nebraska	77.89%
Nevada	41.18%	New Hampshire	100%
New Jersey	100%	New Mexico	90.91%
New York	96.77%	North Carolina	100%
North Dakota	98.11%	Ohio	95.45%
Oklahoma	76.92%	Oregon	100%
Pennsylvania	91.04%	Rhode Island	100%
South Carolina	97.83%	South Dakota	83.33%
Tennessee	100%	Texas	100%
Utah	93.1%	Vermont	100%
Virginia	94.74%	Washington	100%
West Virginia	98.18%	Wisconsin	97.22%
Wyoming	78.26%		

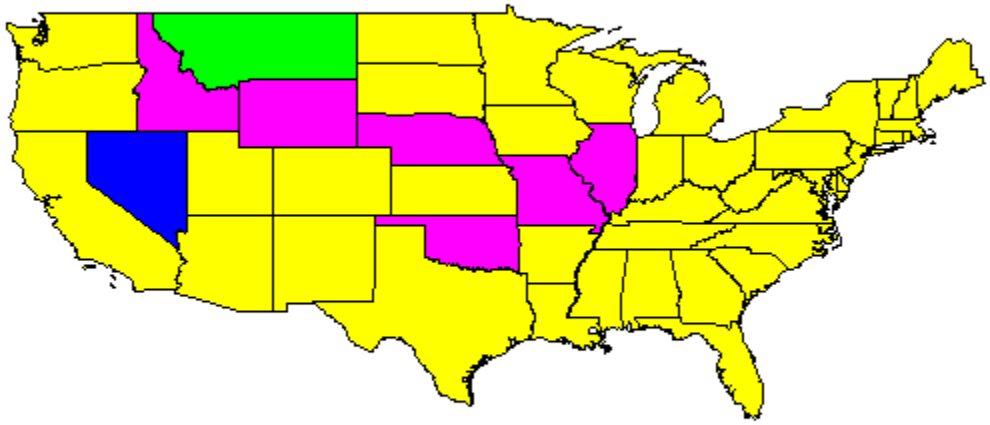
Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Table A-1.3. Percentage Of Counties That Feel They Are Ready To Accept Phase I Wireless Calls

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	95.52%	Alaska	41.67%
Arizona	93.33%	Arkansas	93.33%
California	98.28%	Colorado	98.41%
Connecticut	100%	DC	100%
Delaware	100%	Florida	100%
Georgia	85.53%	Hawaii	100%
Idaho	68.18%	Illinois	79.41%
Indiana	100%	Iowa	100%
Kansas	80.95%	Kentucky	97.5%
Louisiana	95.31%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	89.02%	Missouri	78.26%
Montana	37.5%	Nebraska	63.44%
Nevada	47.06%	New Hampshire	100%
New Jersey	100%	New Mexico	84.85%
New York	98.39%	North Carolina	100%
North Dakota	100%	Ohio	95.45%
Oklahoma	76.62%	Oregon	100%
Pennsylvania	86.57%	Rhode Island	100%
South Carolina	97.83%	South Dakota	89.39%
Tennessee	100%	Texas	100%
Utah	96.55%	Vermont	100%
Virginia	96.99%	Washington	100%
West Virginia	94.55%	Wisconsin	95.83%
Wyoming	73.91%		

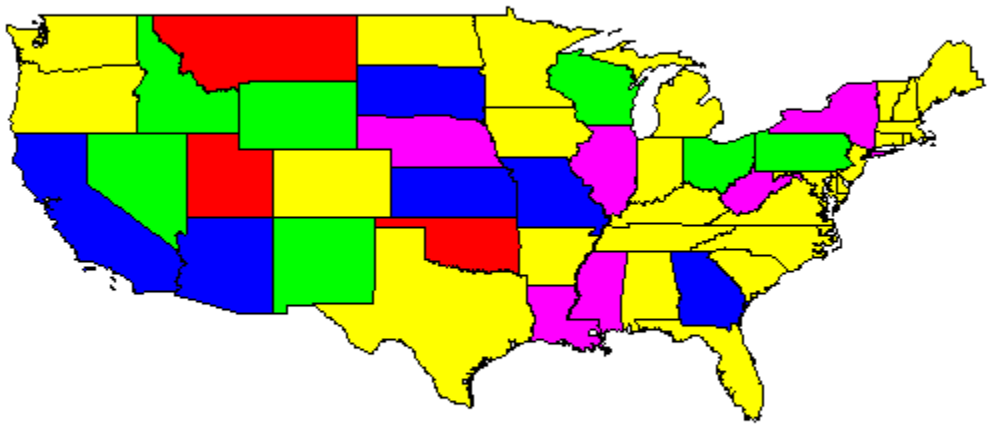
Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Table A-1.4. Percentage Of Counties That Have Implemented Phase I Deployments

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	94.03%	Alaska	8.33%
Arizona	46.67%	Arkansas	93.33%
California	41.38%	Colorado	88.89%
Connecticut	100%	DC	100%
Delaware	100%	Florida	88.06%
Georgia	57.86%	Hawaii	25%
Idaho	25%	Illinois	75.49%
Indiana	98.91%	Iowa	100%
Kansas	42.86%	Kentucky	97.5%
Louisiana	78.12%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	76.83%	Missouri	42.61%
Montana	7.14%	Nebraska	60.22%
Nevada	23.53%	New Hampshire	100%
New Jersey	100%	New Mexico	36.36%
New York	75.81%	North Carolina	100%
North Dakota	100%	Ohio	27.27%
Oklahoma	15.58%	Oregon	100%
Pennsylvania	34.33%	Rhode Island	100%
South Carolina	95.65%	South Dakota	45.45%
Tennessee	100%	Texas	99.61%
Utah	13.79%	Vermont	100%
Virginia	95.49%	Washington	100%
West Virginia	74.55%	Wisconsin	26.39%
Wyoming	30.43%		

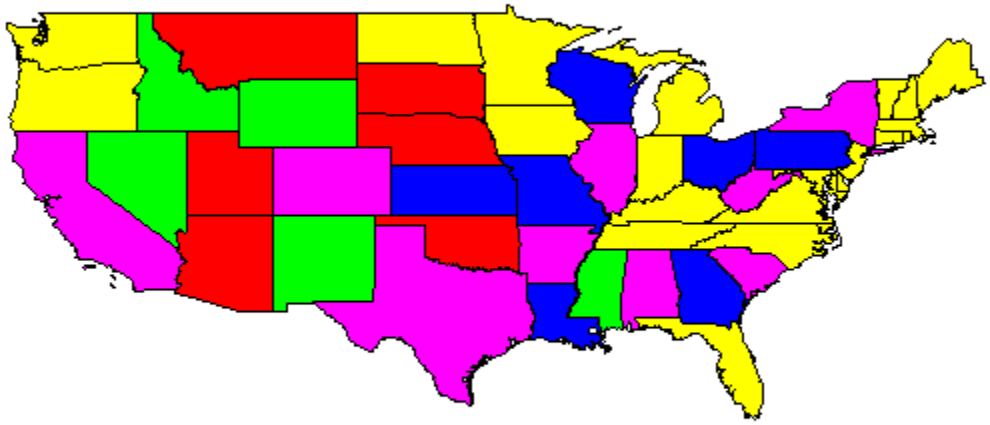
Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Table A-1.5. Percentage Of Counties That Feel They Are Ready To Accept Phase II Wireless Calls

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	76.12%	Alaska	8.33%
Arizona	20%	Arkansas	70.67%
California	75.86%	Colorado	61.9%
Connecticut	100%	DC	100%
Delaware	100%	Florida	89.55%
Georgia	45.28%	Hawaii	25%
Idaho	27.27%	Illinois	69.61%
Indiana	100%	Iowa	84.85%
Kansas	50.48%	Kentucky	85.83%
Louisiana	46.88%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	31.71%	Missouri	40.87%
Montana	16.07%	Nebraska	7.53%
Nevada	29.41%	New Hampshire	100%
New Jersey	100%	New Mexico	33.33%
New York	74.19%	North Carolina	94%
North Dakota	100%	Ohio	53.41%
Oklahoma	11.69%	Oregon	100%
Pennsylvania	44.78%	Rhode Island	100%
South Carolina	78.26%	South Dakota	16.67%
Tennessee	100%	Texas	75.98%
Utah	17.24%	Vermont	100%
Virginia	95.49%	Washington	100%
West Virginia	65.45%	Wisconsin	56.94%
Wyoming	34.78%		

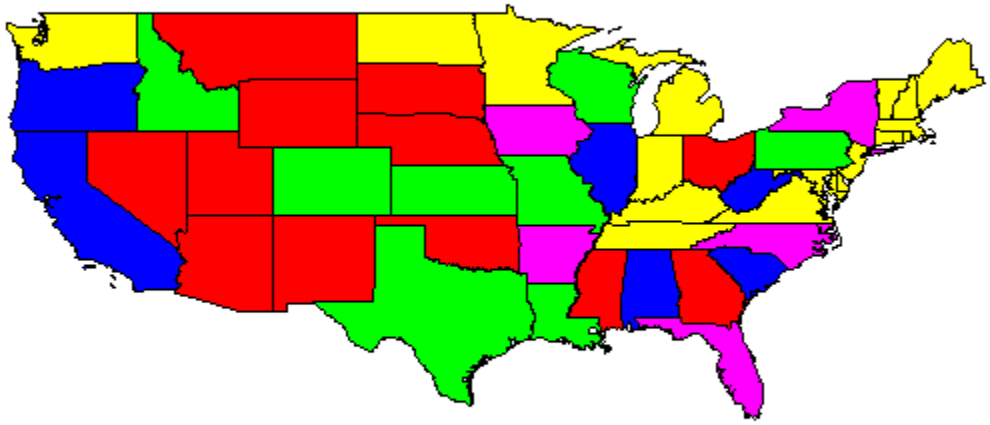
Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Table A-1.6. Percentage Of Counties That Have Implemented Phase II Deployments

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	59.7%	Alaska	4.17%
Arizona	13.33%	Arkansas	61.33%
California	41.38%	Colorado	33.33%
Connecticut	100%	DC	100%
Delaware	100%	Florida	73.13%
Georgia	18.87%	Hawaii	25%
Idaho	20.45%	Illinois	53.92%
Indiana	94.57%	Iowa	76.77%
Kansas	32.38%	Kentucky	85%
Louisiana	25%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	10.98%	Missouri	33.04%
Montana	7.14%	Nebraska	2.15%
Nevada	17.65%	New Hampshire	100%
New Jersey	95.24%	New Mexico	15.15%
New York	66.13%	North Carolina	75%
North Dakota	98.11%	Ohio	7.95%
Oklahoma	1.3%	Oregon	41.67%
Pennsylvania	23.88%	Rhode Island	100%
South Carolina	58.7%	South Dakota	18.18%
Tennessee	100%	Texas	20.08%
Utah	10.34%	Vermont	100%
Virginia	84.96%	Washington	100%
West Virginia	45.45%	Wisconsin	23.61%
Wyoming	13.04%		

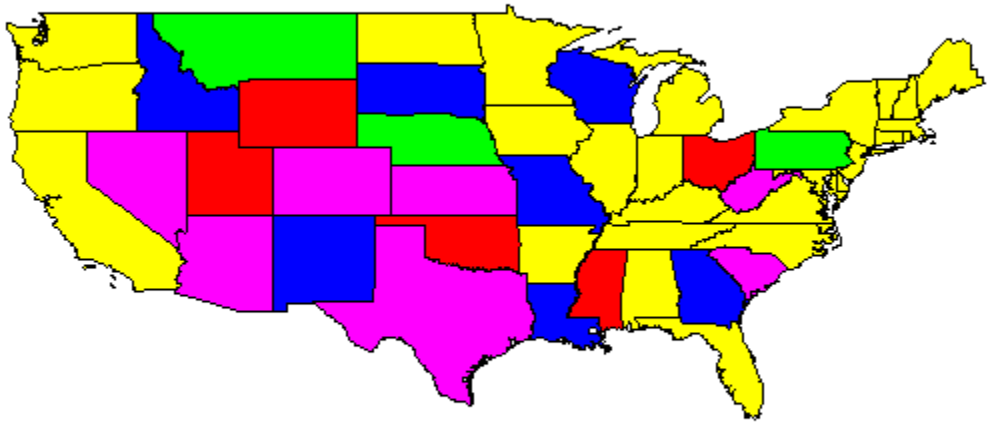
Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Table A-1.7. Percentage Of State Population That Has Some Phase II Coverage

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	83.11%	Alaska	41.48%
Arizona	76.49%	Arkansas	81.2%
California	86.94%	Colorado	79.66%
Connecticut	100%	DC	100%
Delaware	100%	Florida	81.69%
Georgia	50.21%	Hawaii	11.03%
Idaho	50.18%	Illinois	87.16%
Indiana	97.71%	Iowa	82.07%
Kansas	74.55%	Kentucky	91.62%
Louisiana	55.56%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	18.47%	Missouri	56.92%
Montana	25.53%	Nebraska	34.38%
Nevada	74.4%	New Hampshire	100%
New Jersey	92.82%	New Mexico	49.87%
New York	84.31%	North Carolina	87.74%
North Dakota	99.37%	Ohio	3.62%
Oklahoma	1.32%	Oregon	86.39%
Pennsylvania	32.33%	Rhode Island	100%
South Carolina	63.61%	South Dakota	46.13%
Tennessee	100%	Texas	72.59%
Utah	7.6%	Vermont	100%
Virginia	95.08%	Washington	100%
West Virginia	61.27%	Wisconsin	50.45%
Wyoming	14.18%		

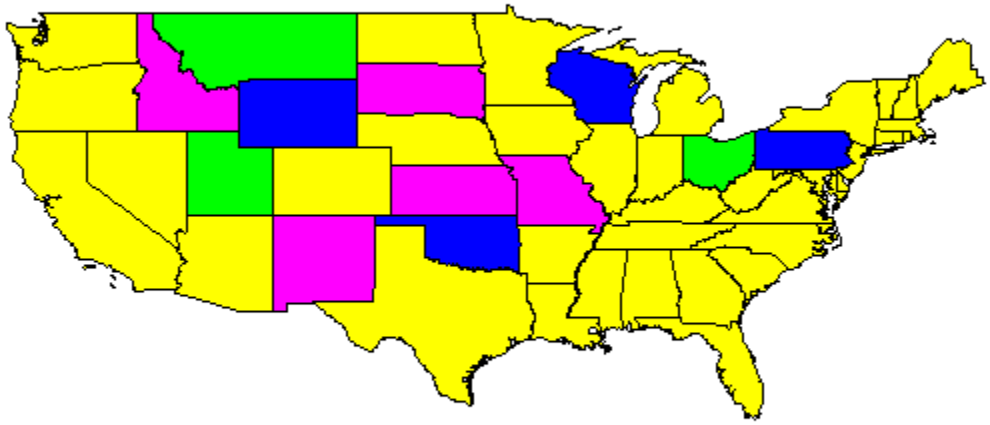
Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Table A-1.8. Percentage Of State Population That Has Some Phase I Coverage

By State

Continental US



Alaska

Hawaii

Breakdown By State

Alabama	98.61%	Alaska	49.49%
Arizona	85.45%	Arkansas	98.23%
California	86.94%	Colorado	98.92%
Connecticut	100%	DC	100%
Delaware	100%	Florida	85.22%
Georgia	87.42%	Hawaii	11.03%
Idaho	61.52%	Illinois	97.02%
Indiana	99.83%	Iowa	100%
Kansas	79.91%	Kentucky	98.7%
Louisiana	93.95%	Maine	100%
Maryland	100%	Massachusetts	100%
Michigan	100%	Minnesota	100%
Mississippi	91.52%	Missouri	63.95%
Montana	25.53%	Nebraska	87.69%
Nevada	90.2%	New Hampshire	100%
New Jersey	100%	New Mexico	65.8%
New York	93.69%	North Carolina	100%
North Dakota	100%	Ohio	22.76%
Oklahoma	52.3%	Oregon	100%
Pennsylvania	56.31%	Rhode Island	100%
South Carolina	99.18%	South Dakota	62.51%
Tennessee	100%	Texas	99.79%
Utah	24.44%	Vermont	100%
Virginia	98.41%	Washington	100%
West Virginia	86.95%	Wisconsin	54.5%
Wyoming	46.84%		

Report Prepared On 5/3/2006

Data is updated using the Wireless Carrier Quarterly Reports filed with the FCC.

Appendix 2: State Wireless Funding – Surcharges

Range of 9-1-1 Surcharges
Exact amounts may be adjusted locally
(April, 2006)

State	Wireline	Wireless
Alabama	5% of Base Rate	$0.70
Alaska	$0.50 - $2.00	$0.50 - $2.00
Arizona	$0.37	$0.37
Arkansas	5% of Basic Rate	$0.50
California	.65% of intrastate calls	.65% of intrastate calls
Colorado	$0.40 - $1.25 (max)	$0.40 - $1.25 (max)
Connecticut	$0.19	$0.19
Delaware	$0.50	$0.60
District of Columbia	$0.60 - $3.00	$0.60
Florida	$0.34 – 0.50	$0.50
Georgia	$1.50	$1.00
Hawaii	$0.27	$0.66
Idaho	$1.00 (max)	$1.00 (max)
Illinois	$0.29 - $5.00	$0.75 $1.25 City of Chicago
Indiana	3% or 10% of Monthly Access	$0.50
Iowa	$0.25 - $1.00	$0.65
Kansas	$0.75 (max)	$0.50
Kentucky	$0.36 - $4.00	$0.70
Louisiana	$1.00 Res $2.00 Bus (max)	$0.85 (max)
Maine	$0.50	$0.50
Maryland	$1.00 (max)	$1.00 (max)
Massachusetts	$0.85	$0.30
Michigan	$0.19 - $4.00	$0.29
Minnesota	$0.65	$0.65
Mississippi	$1.00 Res $2.00 Commercial (25 Lines)	$1.00
Missouri	15% of Base Rate	None
Montana	$0.50	$0.50
Nebraska	$0.25 - $1.00	$0.50
Nevada	Varies – Some Property Tax Some Surcharge – $1.00 (max)	County by County City by City - $1.00 (max)
New Hampshire	$0.42	$0.42
New Jersey	$0.90	$0.90
New Mexico	$0.51	$0.51

New York	**$0.35**	**$1.20 - $1.50**
North Carolina	**$0.25 - $2.00**	**$0.80**
North Dakota	**$1.00**	**$1.00**
Ohio	**$0.50 (max)** **(limited to a few Counties, no general surcharge)**	**$0.32**
Oklahoma	**3-15% of monthly recurring charges**	**$0.50 (Approx. 4 Counties)**
Oregon	**$0.75**	**$0.75**
Pennsylvania	**$0.74 - $1.50**	**$1.00**
Rhode Island	**$1.00**	**$1.00**
South Carolina	**Based on access lines**	**$0.60**
South Dakota	**$0.75**	**$0.75**
Tennessee	**$0.65 - $2.00 / $1.50 - $3 special**	**$1.00**
Texas	**$0.50** **Less than 1% on intrastate calls**	**$0.50** **Less than 1% on intrastate calls**
Utah	**$0.65**	**$0.65**
Vermont	**Universal Service Funding**	**Universal Service Funding**
Virginia	**$3.00 (max)**	**$0.75**
Washington	**$0.20 Statewide** **$0.50 by Counties**	**$0.70**
West Virginia	**$0.55 - $3.75 by County**	**$1.48**
Wisconsin	**$0.40 - $1.00**	**$0.83**
Wyoming	**$0.50 – 0.75**	**$0.50 – 0.75**

Appendix 3: Priority Action Plan

U.S. Department of Transportation Wireless E9-1-1 Initiative
Priority Action Plan

Statement of Principle

We recognize that our six priorities are interdependent and that successful implementation requires effective working relationships to be created and maintained among stakeholders in the private sector as well as at all levels of Federal, State, County and local government. Additional stakeholders may be identified and should be included.

(1) Establish Support for Statewide Coordination and Make Points-of-Contact

Need Statement

By nature, wireless service is not limited to specific jurisdictional or governmental boundaries. However, implementation and the recovery of costs associated with implementation are often, a function of such boundaries. The relationship of the two, therefore, can be a very complex and confusing mix of service providers, vendors, and public safety entities.

Discussion

Effective implementation of wireless E9-1-1 requires that activities be planned, coordinated, and monitored in an efficient and productive way—one that involves all private and public safety stakeholders. However, institutional and administrative approaches to this process vary greatly among States. The 1999 Wireless Telecom Act encourages States to adopt a single point of contact for such activity. Indeed, the Act requires the FCC to "encourage and support efforts by States to deploy comprehensive end-to-end emergency communications infrastructure and programs, based on coordinated statewide plans, including seamless, ubiquitous, reliable wireless telecommunications networks and enhanced wireless 9-1-1 service."

This approach potentially raises issues of local control and governance. Emergency response is ultimately a local governmental responsibility, and traditionally emergency communications has been the same. Historically, administrative and cost recovery infrastructure has reflected that approach. New technology, on the other hand, including, but not limited to wireless E9-1-1, is forcing these institutional arrangements to be reexamined. That is paramount, recognizing their importance to public safety and homeland security.

While many states have adopted implementation and cost recovery approaches emphasizing a single statewide point of coordination and facilitation, a great degree of diversity exists in the detail of those approaches. Furthermore, ten states have yet to adopt any implementation approach, yet alone one at the state level. In light of that, this action item has two goals: 1) to assist the ten states that have not adopted an implementation approach to explore the policy and implementation issues involved, and move forward; and,

2) to foster statewide coordination in deploying wireless E9-1-1 utilizing a single statewide point-of-contact.

Political realities not withstanding, it is reasonable to assume that state government should have an inherent interest in promoting and facilitating the implementation of E9-1-1 service from a standard of care position. However, it is recognized that the methodology that a particular state may or may not employ could vary greatly and still achieve equal levels of success. Furthermore, it is recognized that the process for statewide coordination may range from one of facilitating and regulating deployment at the state and local level or one where the state may simply act as a facilitator that creates a forum for voluntarily cooperation and coordination to occur. It is also important to note that a single point of contact may be a single individual appointed to act as state coordinator or a group of individuals or associations that serve in an advisory capacity to the state. These may range from ad hoc groups and associations of local 9-1-1 interests, to state APCO and NENA chapters, and similar coordination mechanisms. These recommended action items are not intended to preempt any local jurisdiction from aggressively and independently pursuing deployment. Nor, is it the intent of this action item to promote a one size fits all model. What is intended is to insure that there is a recognized individual, group, or association in place in each state that is actively engaged in coordinating and/or facilitating the deployment of wireless location technology, and helping overcome the inter-jurisdictional issues involved. Ultimately, these approaches should balance local interests and responsibilities with regional and state perspective. More than anything else, this action item should emphasize local action, with global thinking.

Key Resource Stakeholders

Fostering statewide, coordinated approaches potentially involves several stakeholders, including:

- Wireless service providers;
- 9-1-1 network service providers;
- Potentially, other Customer Premise Equipment (CPE) vendors and support service providers;
- The Federal Communications Commission (FCC), and other involved federal agencies like the US Department of Transportation (DOT), FEMA and DOJ;
- National Association of State Nine-One-One Administrators (NASNA), and members;
- National Emergency Number Association and Association of Public Safety Communication Officials (NENA and APCO), including Chapter Leadership, and members;
- Cellular Telecommunications and Internet Association (CTIA), and members;
- United States Telephone Association (USTA), and related state telephone associations;
- National Governors Association (NGA);
- American Association of State Highway Transportation Officials (AASHTO);
- National Conference of State Legislatures (NCSL);
- National League of Cities (NLC), along with state municipal leagues;
- National Association of Counties (NACO), along with state county associations;
- State Governors, and their respective offices;
- State legislatures, along with relevant Committee leadership;
- National Sheriffs' Association; and
- Other state and local public safety and health functions and associations.

Action Plan by Task

1.a. Clarify and interpret national policy in this area, as necessary.

Lead Stakeholder: FCC

Time Period: through FY '04 (2nd Qtr)

Contributing Stakeholders: NENA, APCO and NASNA

Comment: By legislation, Congress has already established national policy in this area, and the FCC has promulgated rules implementing that policy. Interpretative guidance by the FCC may be appropriate and beneficial, as necessary. The national associations, including NENA's SWAT initiative, may also help provide coordination in this area.

Critical Factors:
- Implementation of this policy depends upon state and local public policy, and associated implementation approaches.
- Leadership will be critical.
- Further Congressional Action may be necessary.
- Program and Project coordination can be provided in many ways.

1.b. Provide technical assistance and guidance to states without coordinating infrastructure or resources.

Lead Stakeholder: NASNA and its membership

Time Period: through FY '04

Contributing Stakeholders: NENA and APCO

Comment: NASNA and its membership, reflect the intent of this action item, and are in a position to assist states in establishing legislation and statewide coordinating infrastructure. NASNA should organize itself to provide that kind of support. NENA and APCO can assist in developing, documenting and distributing model efforts, legislation and policy. NENA's SWAT initiative is particularly focused at this effort.

Critical Factors:
- Funding, time and resources (can not depend upon solely volunteer effort).
- Leadership will be critical.
- Efforts must be focused to specific situations and locations within the state and local arena.

1.c. Provide leadership to foster new public policy and similar efforts in states without such structure.

Lead Stakeholders: Governors and their offices, State Legislatures

Time Period: through FY '04

Contributing Stakeholders: NGA, NCSL, USTA, NENA, APCO and NASNA

Comment: All of the above Stakeholders have a role to play in this effort. Ultimately the lead role is at the state level. NGA and NCSL can provide guidance, support and

encouragement. So can the public safety community, along with state municipal and county associations, the three national associations and the wireless industry.

Critical Factors:
- Experiences and support should be provided state and local governments to help establish appropriate public policy.
- Efforts must be focused to specific needs and situations.
- Additional funding and resources may be required to provide comprehensive and effort support.

1.d. Monitor status and progress of deployment.

Lead Stakeholders: NENA and APCO

Time Period: through FY '05

Contributing Stakeholders: NASNA

Comment: Good public policy and procedure depends upon good descriptive and factual information. Keeping track of deployment characteristics across the country will be essential to properly coordinating and managing the implementation process. NENA, along with APCO, with support from a variety of sources, are currently under contract to help perform this function.

Critical Factors:
- Maintaining and updating this resource will be critical. That may require additional resources beyond 2003.
- Self-reporting of status information and data will be helpful.

1.e. Develop white paper on the advantages and disadvantages of statewide 9-1-1 institutions.

Lead Stakeholders: NASNA and CTIA

Time Period: FY '03 (3rd Qtr)

Contributing Stakeholders: NENA, APCO, NGA, NCSL

Comment: While ultimately acknowledging the inherent advantages of statewide coordination this paper should also reflect the potential disadvantages of focusing implementation, coordination and oversight at the state level. Special attention should be specifically focused in the areas of local control and governance, and the distribution of wireless revenues for the purpose of cost recovery. Parochial interest not withstanding, ideally the intent of this action item should be to provide a fair assessment of the advantages and disadvantages of statewide coordination.

Critical Factors:
- Review should not only address coordination options, but implementation and funding options as well.
- Timing will be important.
- NENA's SWAT Initiative will explore advantages and disadvantages of various funding options.

1.f. Educate local stakeholders

Lead Stakeholders: Steering Council

Time Period: through FY '04

Contributing Stakeholders: Steering Council members, Expert Working Group members

Comment: This task involves the products of this "Priority Action Item" and their implementation through member constituencies, state, regional and local memberships, as appropriate. A variety of models may be described, reflecting various approaches to program implementation and coordination. NENA's and APCO's current contract with DOT, along with NENA's SWAT Initiative, APCO's Public Safety Foundation, and other resources can contribute.

Critical Factors:
- To some extent, assistance under this item must be focused to specific states and their local characteristics.
- Additional resources and funding may be required.

(2) Help Convene Stakeholders in Appropriate 9-1-1 Regions

Need Statement

Effective implementation of wireless service requires a coordinated effort by everyone involved in the process. A primary need, then, is to convene all stakeholders – both public and private, to ensure a coordinated effort. After defining respective roles and responsibilities at each level, a plan for implementation will be developed. Developing practical solutions to institutional barriers and other issues, as they arise, are critical to the success of the effort. Stakeholders will be convened frequently to monitor progress toward achieving the goals as outlined in the action plan for each region or location. Effective communications will facilitate that effort.

Discussion

Effective implementation of wireless E9-1-1 requires cooperation between agencies of the federal government (e.g. the FCC and DOT), state governments (primarily state wireless coordinators, where they exist), local governments (especially county 9-1-1 coordinators), and the private sector. Each level of government must understand and respect the roles and responsibilities of other government entities, in order to achieve wireless E9-1-1 implementation in a well-planned manner. Clear-cut interactions between government, public safety organizations, the telecommunications industry (wireless carriers and local exchange carriers, or LECs) and other commercial firms need to be defined.

Appropriate leads for convening stakeholders will likely come from organizations such as NASNA and NGA. Both are active in wireless 9-1-1 issues at the state and national levels, and have access to decision-makers that can have a positive impact on implementation. Private-sector stakeholders include wireless carriers, 9-1-1 network service providers, and others involved in the implementation of wireless E9-1-1.

In preparation for the 9-1-1 wireless deployment surveys under the DOT project, NENA has already completed the first ever compilation of 9-1-1 county coordinators. This information

will be of value not only to the survey, but also for other tasks that involve government stakeholders.

Government at all levels must also monitor implementation of wireless E9-1-1 to ensure citizens that there is no degradation of 9-1-1 services. It is important to establish ways in which to measure quality of service that are easily understood and for which data can be collected.

Resource Stakeholders

There are many government stakeholders, including:

- Federal Communications Commission;
- DOT;
- American Association of State Highway Transportation Officials (AASHTO)
- State 9-1-1 Coordinators (most are members of National Association of State Nine-One-One Administrators – NASNA);
- National Association of Counties (NACO);
- United States Telephone Association (USTA), and related state telephone associations;
- County 9-1-1 Coordinators (most are members of National Emergency Number Association – NENA);
- County Commissioners;
- Municipalities;
- Wireless carriers;
- 9-1-1 network service providers;
- CPE vendors; and
- Other 9-1-1 service providers (e.g. telematics service providers).

Action Plan by Task

2.a. Identify leads for convening stakeholders and define roles and responsibilities.

Lead Stakeholders: NASNA and NGA

Time Period: FY '03 (3rd Qtr)

Comment: It is important that appropriate leads for convening stakeholders be identified, and that roles and responsibilities are defined. NASNA and NGA represent state-level organizations that must be part of any implementation process. Other stakeholders will also be identified.

Critical Factors:
- Identify appropriate divisions/individuals within NASNA and NGA.
- May require additional dedicated resources to support lead stakeholder role (APCO's Public Safety Foundation may be a possible source).

2.b. Develop a mini-plan, including a "roadmap" for stakeholders.

Lead Stakeholders: NENA and APCO

Time Period: FY '03 (3rd Qtr)

Contributing Stakeholders: NGA, NASNA, AHA, CTIA, USTA and AASHTO

Comment: This mini-plan will guide the work to be accomplished. It will serve as a "roadmap" for all stakeholders that identifies steps to be taken by public and private partners that provide a path to wireless E9-1-1 deployment. It will include a Gantt Chart of tasks and milestones, best methods to convene all stakeholders (workshops, summit-type meeting, web conferencing), and target dates that may coincide with DOT schedules for expert committee and steering committee meetings. Parallel efforts by other general public/special interest groups will be recognized and to the extent possible, incorporated into the mini-plan.

Critical Factors:
- NENA will be the lead association for the mini-plan. This is consistent with the DOT project.

2.c. Identify appropriate parties.

Lead Stakeholder: NENA, APCO and NASNA

Time Period: FY '03 (2nd Qtr)

Comment: This task will identify appropriate parties at each governmental level, with the product being a list of organizations and individuals to represent each entity. Private-sector stakeholders will also be identified.

Critical Factors:
- Activities under the DOT Wireless E9-1-1 Initiative have identified stakeholders, which will form the first-cut list of appropriate parties.
- Additional stakeholders may need to be identified.

2.d. Determine method(s) to involve all stakeholders.

Lead Stakeholder: NENA, NGA and NACO

Time Period: FY '03 (3rd Qtr)

Contributing Stakeholder: DOT

Comment: Identify events (e.g. conferences) where we can "piggyback" on attendees already convening. Prepare single guidance document for all states/counties.

Critical Factors:
- Will meet with NGA and NACO to accomplish this task.
- Funding and other resources may be a factor.

2.e. Develop agenda for each event.

Lead Stakeholders: NENA and APCO

Time Period: FY '03 (3rd Qtr)

Comment: Agendas for each event will be targeted to all stakeholders involved, and what would be accomplished in each respective region.

Critical Factors:
- DOT project staff will lead this effort.

2.f. Schedule meetings and hold events.

Lead Stakeholders: Government agencies and private-sector partners

Time Period: through FY '04

Contributing Stakeholders: NENA, APCO, AASHTO and NASNA

Comment: Events may include meetings, workshops, and web conferences. Following each event, major findings will be documented and distributed to all interested parties.

Critical Factors:
- A detailed calendar of meetings and events will be prepared by the DOT project staff.

2.g. Monitor implementation of stakeholder convening actions

Lead Stakeholders: NASNA

Time Period: through FY '04

Comment: Over time stakeholders will implement various actions to implement wireless E9-1-1. This subtask entails monitoring those actions and their positive impact on implementation. Progress will be reported back to all stakeholders so that successes can be shared among all parties.

Critical Factors:
- NASNA will appoint a working group to monitor implementation and will develop a reporting mechanism. May require support from NENA and APCO.
- May require additional funding and resources.

(3) Examine Cost Recovery and Funding Issues

Need Statement

The lack of the ability to recover the costs of wireless implementation can be a barrier for public safety or the carrier. By FCC rules this is a state and local issue, not a federal issue. The barrier goes beyond just the question of whether cost recovery exists and includes how the cost recovery funds will be utilized.

Discussion

The FCC has ruled that PSAPs are responsible for recovering costs for their own upgrades and enhancements back through the selective router, and that the carriers are responsible for their costs down to the selective router. However, states are permitted to reimburse the carrier's expenses if they so choose. Today forty states have some type of cost recovery mechanism in place, with wide variances in the amount of the fees, the method of applying and collecting the fees, the allowable use of the fees, and the administrative oversight of the fee distribution and usage. This lack of consistency adds to the confusion of which wireless carriers costs are to be reimbursed by the state or the PSAP and which are to be covered by the carrier through their own rate base.

States need to clarify which expenses are eligible for recovery through their state plans and which the carriers are expected to cover through their rate base. Firm guidelines on such issues as system configuration, system cost, and which portions of the plan each is responsible for need to be established to guide the carriers and the PSAPs in their negotiations as they work through the implementation process. Making this information

widely available will speed the implementations. Much time is lost today as these things are negotiated repeatedly with each PSAP.

States that do not have any type of cost recovery mechanism need to review this issue and see if that is the most beneficial policy for their citizens. Those that choose not to implement a statewide fee should set guidelines for the PSAPs and carriers to follow so that each will know their responsibilities.

States that have a funding mechanism in place need to review their program and determine if it is working and if the income projections are adequate to cover the anticipated expenses. In the event of projected shortfalls they should be prepared to revise their fee schedule or make clear which expenses they expect to cover and which ones they expect the wireless carriers to recover (which, in turn may include the development of guidelines on acceptable charges for these services). Wide variances in rate quotes from carriers on what appear to be similar items are causing delay in many areas. Allowable guidelines will be beneficial in speeding the process of cost reimbursement and thereby speeding deployment. These states should be prepared to make a thorough analysis of their entire process to see if it is working and if it can be improved.

Resource Stakeholders

- PSAP officials;
- Wireless Carriers;
- Emergency Services Interconnection Forum (ESIF);
- Local Exchange Carriers;
- American Association of State Highway Transportation Officials (AASHTO);
- National Association of Regulatory Commissions (NARUC);
- National, Regional, and Rural wireless carriers;
- National Association of State Nine-One-One Administrators (NASNA), and members;
- National Governors Association (NGA);
- National Conference of State Legislatures (NCSL);
- National Emergency Number Association and Association of Public Safety Communication Officials (NENA and APCO), including Chapter Leadership, and members;
- United States Telephone Association (USTA);
- American League of Cities (NLC), along with state municipal leagues;
- National Association of Counties (NACO), along with state county associations;
- State Governors, and their respective offices; and
- State legislatures, along with relevant Committee leadership.

Action Plan

3.a. Clarify policy as established by the FCC and by precedent.

Lead Stakeholder: FCC

Contributing Stakeholders: ESIF, NENA, APCO and NASNA

Time Period: FY '04 (2nd Qtr)

Comment: The FCC has ruled that the selective router will be the demark for cost splitting, but this ruling needs to be more specific on certain cost items. How the FCC

ruling is applied to the technical or mechanical delivery of a wireless E9-1-1 call (in light of the nature and approach of the ruling) may affect cost recovery responsibility in some states. It is noted that the ESIF is attempting to help address this clarification issue (by clarifying—not developing). Additionally, the issue of only "partial" cost recovery being available to carriers in some states needs to be addressed to prevent this being a roadblock.

Critical Factors:
- More-specific FCC rulings/clarifications as necessary.
- Cost and practice standardization by the industry.

3.b. Provide education to PSAPs on reasonable expense allocation.

Lead Stakeholders: APCO, NASNA, NENA, USTA and NARUC

Time Period: FY '04 (3rd Qtr)

Comment: The PSAPs need to know which expenses they can reasonably be expected to cover, which the carriers should cover, and receive guidance that will help them through negotiations with the carriers.

Critical Factors:
- Development of educational material using data from models and successful implementations.
- Establishment of cost models by wireless carriers.
- Development and distribution of upgrade guidelines (equipment needs, software needs, network requirements, cost estimates).
- Cooperative, and coordinated efforts by public safety agencies in providing education opportunities and materials.
- Funding methods to allow low-cost symposiums/forums for PSAPs to attend.
- Knowledgeable writers to develop articles for publication, to explain technical subject matter in laymen's terms, and wide publication of these articles.

3.c. Educate PSAPs about their responsibilities in Phase II implementation.

Lead Stakeholders: APCO, NENA

Time Period: FY '04 (3rd Qtr)

Comment: Much confusion still exists regarding what actions need to be taken, which expenses each party my incur, and what how much is a reasonable amount to pay.

Critical Factors:
- Cooperative, and coordinated efforts by public safety agencies in providing education opportunities and materials.
- Funding methods to allow low-cost symposiums/forums for PSAPs to attend.

3.d. Develop guidelines and tools to assist in generating cost estimate analyses.

Lead Stakeholders: APCO, NENA and NARUC

Time Period: FY '04 (1st Qtr)

Comment: Development of a "cook book" on implementing Phase II will be very beneficial to agencies involved in the learning process.

Critical Factors:
- Development of educational material using data from models and other successful implementations.
- Establishment of cost models by carriers.
- Development of upgrade guidelines.

3.e. Prepare and publish some example cost estimates as guidelines.

Lead Stakeholders: DOT, APCO, AASHTO and NENA

Time Period: FY '04 (1st Qtr)

Comment: As systems are implemented we should gather the actual costs of the various components and make them available to other agencies, identifying where appropriate that these may vary with local tariffs.

Critical Factors:
- Development of educational material using data from models and other successful implementations.
- Establishment of cost models by carriers.
- Development of upgrade guidelines.

3.f. Identify potential funding sources and make information available to PSAPs.

Lead Stakeholders: DOT, APCO, AASHTO and NENA

Time Period: FY '04

Comment: From a broad perspective identify potential funding sources (like APCO's Public Safety Foundation, and other public and private sources). Make this information available through websites and distribution channels used for all educational information.

Critical Factors:
- Identification of useable information.
- Wide dissemination of this information, particularly to PSAPs outside of the "mainstream."

(4) Initiate Program of Knowledge Transfer and Outreach

Need Statement

A major barrier to accelerated deployment of wireless E9-1-1 is a lack of understanding by many PSAPs of exactly how to go about implementing wireless E9-1-1. Therefore a high priority is to quickly and effectively accomplish knowledge transfer of successful wireless E9-1-1 implementation programs to PSAPs about to embark on their own programs. Knowledge transfer and outreach programs are a proven method to accelerate the rate of adoption of new technologies or programs. Information dissemination to all PSAPs regarding precursor requirements and actions leading to PSAP readiness for Phase II is needed

Discussion

A common pattern in innovation is for early adapters to lead the way for others. So it is with wireless E9-1-1 implementation. There already are many successful programs for Wireless Phase I, and several for Wireless Phase II, most notably by the State of Rhode Island and St. Clair County, Illinois. Early innovators nearly always share their experiences, both good and bad, so that others can benefit from what they did correctly and avoid the problems resulting from mistakes made.

DOT plans to select and work with several "model" states and/or counties to address issues and share lessons learned. Knowledge transfer in this program is intended to accelerate the rate of wireless E9-1-1 implementation. Outreach efforts will identify what PSAPs need to do to prepare for Phase II; that is, to achieve readiness.

Resource Stakeholders

There are many stakeholders to be involved in knowledge transfer, both those who have implemented wireless E9-1-1 and those who are in need of implementing it. Stakeholders include:

- Early adopters (e.g. Rhode Island and St. Clair County, IL);
- Government agencies (e.g. FCC, DOT);
- American Association of State Highway Transportation Officials (AASHTO);
- State 9-1-1 Coordinators (most are members of National Association of State Nine-One-One Administrators – NASNA);
- County 9-1-1 Coordinators (most are members of National Emergency Number Association – NENA);
- County Commissioners;
- Emergency Service Interconnection Forum (ESIF);
- Wireless carriers;
- Local Exchange Carriers;
- Municipalities; and
- Third Party Providers.

Action Plan by Task

4.a. Determine methods for knowledge transfer and outreach.

Lead Stakeholders: AASHTO, NENA and APCO

Time Period: FY '03 (1st Qtr)

Comment: Methods may include written "how-to" products similar to those guidelines already prepared by NENA, white papers on key issues, video tapes, and workshops/seminars. A 12-15 month schedule of when and how these methods will be carried out will be developed.

Critical Factors: DOT project staff will determine methods and develop a 12-15 month schedule.

Funding for widespread distribution of products may become an issue.

4.b. Identify early adopters and document their experiences.

Lead Stakeholders: NASNA, NENA and APCO

Time Period: FY '03 (3rd Qtr)

Comment: Early adopters include the State of Rhode Island, St. Clair County (IL), and those who have already requested Phase II. Their experiences will be documented - what went right, pitfalls to avoid lessons learned, helpful hints to others.

Critical Factors: Ability to identify and contact early adopters. Procedures to do this are already in place with NASNA members.

May require support from APCO and NENA.

May require additional funding and resources.

4.c. Prepare and distribute white papers, videos, and other printed and electronic materials to all stakeholders.

Lead Stakeholders: PSAPs

Time Period: through FY '04

Contributing Stakeholders: NENA, APCO and DOT

Comment: White papers and videos are being prepared by NENA under the scope of the DOT project. These materials will be distributed to PSAPs and other stakeholders from lists developed by NENA and DOT. Outreach to the general public and other special interest groups, such as the AHA and NHLBI, will also be accomplished in this task. Knowledge transfer and outreach will be reviewed on a quarterly basis. This in itself is another form of knowledge transfer important to DOT and other stakeholders

Critical Factors: Timely preparation of white papers.

Distribution lists will be maintained as part of the DOT project.

Costs of video distribution need to be determined.

4.d. Produce a "guidebook" on Phase II deployment

Lead Stakeholders: PSAPs

Time Period: FY '03 (3rd Qtr)

Comment: A guidebook for PSAPs and other stakeholders on how to achieve Phase II deployment will be written and distributed under this Action Plan.

Critical Factors: NENA and APCO will prepare the guidebook, with input and review by appropriate stakeholders.

4.e. Provide expert consulting team to support knowledge transfer and outreach

Lead Stakeholders: DOT

Time Period: through FY '04

Comment: Expert consultants will be available to assist PSAPs with their readiness for wireless E9-1-1 implementation.

Critical Factors: NENA's DOT project staff will be the core of the technical outreach team.

Will require additional funding and resources.

(5) Develop Coordinated Deployment Strategy Encompassing both Rural and Metropolitan Areas

Need Statement

Wireless E9-1-1 deployment tends to be requested by those PSAPs/Public Safety Authorities who are most knowledgeable about 9-1-1 processes and/or who have the most resources to apply to planning, implementation, and costs. This causes service requests that are not only rather random geographically, but also tend toward more metropolitan areas with higher wireless set concentration. Strategies are needed to enable significantly populated rural areas to deploy wireless E9-1-1 more rapidly than would otherwise occur.

Discussion

Effective implementation of wireless E9-1-1 requires that activities be planned, coordinated, and monitored in an efficient and productive way. Ways must be found to coordinate the diverse governmental and service provider environment toward a common plan of attack on roadblocks to rapid deployment of wireless E9-1-1 in rural areas.

Considerations include wireless E9-1-1 knowledge availability (including project planning) to 9-1-1 managers in rural areas of each state, level of technology needed in regard to geographic complexity and population density in each rural area, and identification and applicability of funding sources, including grants. For instance, a single source of expertise funded and available across a state or a group of states might be a means to support the knowledge availability issue. It is noted that work under this action item should be an important contribution to Action Item 1.e. above (white paper dealing with the advantages and disadvantages of statewide approaches and institutions to wireless implementation).

Key Resource Stakeholders

- National Association of State Nine-One-One Administrators (NASNA);
- National Emergency Number Association and Association of Public Safety Communication Officials (NENA and APCO);
- National Governors Association (NGA);
- Federal Communications Commission (FCC);
- Emergency Services Interconnection Forum (ESIF);
- National Association of County Officials NACO;
- United States Telephone Association (USTA), and related state telephone associations;
- Wireless Carriers operating in the region;
- American Association of State Highway Transportation Officials (AASHTO); and
- DOT.

Action Plan by Task

5.a. Develop deployment characteristics.

Lead Stakeholder: NASNA, NGA, and NACO

Time Period: FY '03 (4th Qtr)

Contributing Stakeholders: NENA, APCO, AASHTO, USTA and CTIA

Comment: Identify wireless customer quantities and growth rates on a per-County (or equivalent) basis. Include factors for major highway pass-through and commuter movement between rural and metro areas. Identify present County deployment status. (NENA will have baseline deployment status developed under the NENA-DOT contract in 2002).

Critical Factors: Customer and calling rate information must be developed, by cell tower set associated with Counties, from wireless carriers.

Data on commuter and highway traffic rates from DOT groups.

Reporting capabilities from the NENA/DOT Survey data base.

Potential additional funding to support above.

5.b. Develop project plans and deployment sequence by state, where they do not currently exist.

Lead Stakeholders: NASNA, NENA, and APCO

Contributing Stakeholders: NCSL, NGA, NACO and CTIA

Time Period: through FY '03

Comment: These plans will guide the work to be accomplished. They will include a Gantt chart of tasks and milestones, best methods to convene government stakeholders (workshops, conference calls, and web-based meetings), and target dates. Convene stakeholders by state, and, where needed, identify a lead team from the stakeholder groups, who will then define the wireless deployment state project plan and schedule, based on activities below and additions.

Critical Factors: Model project plan development.

Summary of best practices for stakeholder collaboration methods.

Funding to accomplish above.

5.c. Identify rural area strategies.

Lead Stakeholder: NASNA, NGA, AASHTO and NACO

Time Period: FY '03 (4th Qtr)

Contributing Stakeholders: NENA, APCO, CTIA, USTA and RCA

Comment: Identify strategies for alternate organizational, infrastructure and cost recovery/funding models that can be successfully applied for rural area support.

Critical Factors: Modification of model project plans to match rural factors.

Summary information on best practices for rural stakeholder collaboration methods.

Funding work required as necessary.

5.d. Identify infrastructure needs, and PSAP operational needs.

Lead Stakeholders: NENA

Time Period: FY '04 (1st Qtr)

Contributing Stakeholders: APCO and NASNA

Comment: Identify carriers and 9-1-1 service system providers by County. Identify PSAP, 9-1-1 system, and carrier capability issues, such as network, switching, and data equipment capability, E9-1-1 system upgrade requirements, wireless methodology needs, mapping needs, etc. Identify PSAP call-taking requirements, such as staffing and training, and funding impacts and needs, by County. (NENA will have baseline information developed under the NENA-DOT contract in 2002)

Propose a National policy for call routing, analyze impacts and funding needs for E9-1-1 system upgrade requirements to support call delivery for all service areas (NENA is already working this issue in its Technical Development and SWAT Initiative process).

Critical Factors: Survey and evaluation of remaining info needs, as above.

Funding may be required to accomplish some of the above.

Results of the NENA SWAT Team project, expected 1st half, FY '03

5.e. Identify alternative funding sources and strategies (e.g., rural health program grants)

Lead Stakeholder: NASNA, NENA and APCO

Time Period: FY '03 (3rd Qtr)

Contributing Stakeholders: NGA, NACO, NENA, and APCO

Comment: The stakeholders would identify available and applicable funding sources, such as federal and state monetary sources concerned with national security, public safety, public health, anti-crime, etc. Develop strategies to investigate and apply for funds, prioritizing actions based on deployment sequence. Establish application of funds specifically to wireless E9-1-1 support functions, within any related state law guidelines. The Monitor Group study under NENA's SWAT initiative is directly focused on this issue and task.

Critical Factors: Survey of available funding sources, and applicability.

Develop model grants application package, targeted to 9-1-1 support needs.

5.f. Establish common service agreement/contract

Lead Stakeholder: NASNA, NENA and APCO

Time Period: FY '04 (1st Qtr)

Contributing Stakeholders: NENA, CTIA, NGA, and NACO

Comment: Coordinate service agreements/contracts across jurisdictions (state-county-municipality).

Critical Factors: Develop national wireless readiness evaluation/communications package (done by ESIF and NENA in Nov 2002).

Carrier voluntary contributions under FCC enforcement actions shifted to national public safety efforts.

Complete development of model service agreements and contracts, with in-out and buy-off by all involved parties (started by NENA in 2002).

Funding as required for above.

(6) Implement model location program

Need Statement

A number of issues have been identified as potential barriers to the deployment of wireless telephone location technology. These issues range from PSAP readiness, to who pays for what. Some of the issues are complex and pose some real challenges, while others appear to be more bureaucratic or procedural in nature. The purpose of this action item is to clearly identify and isolate some of these issues in a model or test case environment. The well-documented results of these model programs will greatly assist all stakeholders in understanding what each entity must do to achieve success.

Discussion

These models programs need to represent true cross-sections of the PSAPs, including large, small, and midsize agencies. They should include PSAPs that are technologically advanced as well as those that lack funding resources. They should also represent wireless carriers and local exchange carriers, both large and small. The models will serve to assist the telephone service providers as well as the PSAPs. Through the use of model programs the Steering Committee will need to determine what the critical success factors must be. Careful selection should be made to ensure that a representative sampling of systems is utilized.

In determining the criteria for participation emphasis should be placed on the commitment of all parties involved and not on any monetary incentive that may be derived. While some financial assistance may be forthcoming, it should be clear that the participating PSAP must have it's own ongoing source of self funding. Emphasis should be placed on the technical support and commitment from participating public and private stakeholders. Agencies selected to serve as models must be willing to devote the time necessary to fully document their process and progress. Additionally, the wireless carriers must be willing to make a similar commitment, as this may also a learning process for them as well. The documentation process and the subsequent development of educational case studies is the real value of this action item. Models can be a very effective learning experience and educational tool, but only if they are carefully selected and examined.

It is noted that activities under this Action Plan need to be reviewed to ensure that model sites are providing information that will useful to many. The following criteria are recommended for use in selecting model locations:

1. Cost recovery status (legislation; policy)
2. Leadership
3. Carrier community readiness
4. PSAP readiness
5. LEC readiness
6. Geography (mix; national location; etc.)
7. Metro/rural
8. Homerule v. centralized State authority
9. Interoperability with public safety.

Resource Stakeholders

- National Association of State Nine-One-One Administrators (NASNA), and members;
- DOT;
- PSAP officials;
- CTIA/USTA/Telephone Service Providers;
- National Governors Association (NGA);
- National Conference of State Legislatures (NCSL);
- American Association of State Highway Transportation Officials (AASHTO);
- National Emergency Number Association and Association of Public Safety Communication Officials (NENA and APCO), including Chapter Leadership, and members;
- Emergency Service Interconnection Forum (ESIF);
- National League of Cities (NLC), along with state municipal leagues; and
- National Association of Counties (NACO), along with state county associations.

Action Plan by Task

6.a. Establish criteria for selection of model locations.

Lead Stakeholder: DOT Wireless E9-1-1 Steering Council

Time Period: FY '03 (3rd Qtr)

Contributing Stakeholder: Expert Working Group

Comment: To achieve maximum effectiveness it is important that the models be carefully selected based on their demographics and technical ability to serve as effective role models. Factors that may be included in the selection criteria include:

i. Leadership
   - Strong statewide
   - Decentralized
   - Progress
   - Rural/urban – state planning

ii. Cost Recovery
   - Collection/disbursement models
   - Cost estimates policy

iii. PSAP Readiness

- Funding
- Education/technical assistance iv.

Political Considerations

- Federal
- State
- Municipal

Critical Factors: Find models well positioned for success.

Models, and their carriers, must show a keen interest in being a role model, willing to document and share their process.

Adequate personnel funded and staffed to accomplish thorough documentation, with acknowledgment and encouragement of this by the implementation team.

6.b. Establish procedures for collecting and analyzing information from the models.

Lead Stakeholders: US DOT

Time Period: FY '04 (1st Qtr)

Contributing Stakeholders: APCO, NENA and NASNA

Comment: This task will be critical to the success of this action item, and will require close cooperation between all three associations. Some guidance may be provided by NENA's Strategic Wireless Action Team (SWAT) initiative.

Critical Factors: Identifying critical areas of need by a "high level" team, and conveying this information to the implementation team.

Creation of an "education attitude" in the implementation team.

6.c. Establish methods of disseminating "lessons learned" to all interested stakeholders.

Lead Stakeholders: DOT

Time Period: FY '04 (1st Qtr)

Contributing Stakeholder: AASHTO, APCO and NENA

Comment: To be effective the information gleaned, and the resulting conclusions, must be promptly distributed to all parties, including PSAPs, Public Safety Associations, Wireless Carriers, and the FCC.

Critical Factors: Cooperative and coordinated efforts by public safety agencies in providing education opportunities and materials.

Establishing funding methods to allow low-cost symposiums and forums for PSAPs.

Appendix 4 White Paper on GIS Wireless

Public Safety Answering Point Managers' Guide to Geographic Information Technology

A National Emergency Number Association White Paper

October 2002

Overview

This paper includes information on how to best deal with wireless information coming into the Public Safety Answering Point (PSAP). Any PSAP that is now, or will be, receiving wireless calls will find this paper useful. This focus of this paper is how to best utilize Geographic Information Systems (GIS) in dealing with wireless calls in the PSAP.

A recent National Emergency Number Association (NENA) Critical Issues Forum identified key concerns of GIS technology in the PSAP as being data quality, integration, and data maintenance. Addressing these issues will become increasingly important as the number of wireless devices making 9-1-1 requests continues to increase. These issues, and possible solutions for PSAPs, are addressed in this white paper.

Wireless calls come into the PSAP as either a Phase I or Phase II call. Phase II calls provide the PSAP a longitude and latitude (X, Y) coordinate pair as part of the Automatic Location Identification (ALI). Cellular telephones, Automatic Vehicle Location (AVL) systems, Automatic Crash Notification (ACN) systems, and other sources will be providing information to PSAPs using geographic (X, Y) location information.

Being able to understand how the geographic coordinates relate to a physical location will be critical in providing proper emergency response. Locating wireless devices depends on having accurate, current, and complete geographic data. The geographic data usually resides in a GIS. The wireless service provider will send geographic (X, Y) coordinates with a Phase II wireless 9-1-1 call. GIS technology can display these coordinates, along with streets and other information, on a map display. Having GIS technology integrated into the premise equipment allows for quick and effective location of wireless and wireline E9-1-1 calls.

What is the best and most cost effective means of dealing with this wireless location information? How does one convert longitude and latitude coordinates into an address to which a vehicle can be dispatched? What level of location technology is needed by the PSAP, what is available, what cost, and how can this technology best be used, managed, and leveraged? The operational, financial, management and technical issues of wireless location technology in a PSAP will be discussed. Since every PSAP is different, this paper will discuss the options available.

Wireless location technology is the major force driving GIS use in the PSAP. Since wireless is driving the interest in GIS, a review of wireless technology is in order.

Introduction to Wireless Phase I and Phase II

Wireless technology is increasing the demand for accurate and complete map displays in the PSAP. For those in the PSAPs rushing to determine the best methods of obtaining accurate and current geographical information, there are many questions to overcome. With the advent of wireless Phase I and Phase II, the need and use of GIS has dramatically increased in PSAPs across the United States. Because of this, it is important to mention the history and wireless definitions of Phase I and Phase II.

History

The public safety community, embodied by several national level professional organizations, National Emergency Number Association (NENA), Association of Public-Safety Communications Officials (APCO), and the National Association of State 9-1-1 Administrators (NASNA), united in 1994 to officially lobby the Federal Communication Commission (FCC). They requested that the FCC provide for service parity between existing wireline E9-1-1 systems and wireless services. They requested wireless subscribers have the same level of service currently provided wireline subscribers. The result of their efforts was the FCC's "Notice of Proposed Rule Making" (NPRM), or FCC Docket # 94-102.

The magnitude of the technical challenge became evident to the communications industry, as well as the 9-1-1 specialists, who had not previously been involved, as soon as the NPRM was released for comment. The result of these comments led the FCC to release a "Report and Order" that identified several phases of implementation, occurring over a specified time, to allow appropriate technological adjustments to bring wireless service up to par with wireline service.

The FCC's wireless E9-1-1 rules require wireless carriers to begin transmission of enhanced location information in two phases. Phase I requires carriers to transmit a caller's phone number and general location to a PSAP. Phase II requires more precise location information to be provided to the PSAP.

Under the current rules, two prerequisites must be met before the wireless carrier is obligated to implement E9-1-1.

(1) The carrier's receipt of a valid request from a PSAP capable of receiving and utilizing the data elements associated with the service; and

(2) The existence of a cost recovery mechanism for recovery of the PSAP E9-1-1 service cost.

Wireless service carriers were to provide the requested E9-1-1 service, six months after the prerequisites are met, or April 1, 1998 (for Phase I) or October 1, 2001 (for Phase II). The FCC has allowed these dates to slip.

Phase I Defined
Wireless Phase I requires that the calling party's call-back number, the cell towers location, and the direction of the cell towers antenna which received the call, all be delivered to the PSAP. The logic in support of these requirements was as follows:

- The caller's number would be used to call back the subscriber in the event the connection is lost with the PSAP
- The location of the receiving antenna would provide a gross level of location information that would allow delivery of the 9-1-1 calls to the appropriate PSAP.

Phase I is the contingency in the event Phase II fails. If Phase II fails, for any reason, then Phase I will be the fall back level of service. Phase I development also creates a migration path to Phase II infrastructure, and creates relationships with all parties involved.

Phase II Defined
Wireless Phase II requires the wireless carrier to provide "more specific latitude and longitude information, known as Automatic Location Identification (ALI) to the dispatcher". (http://wireless.fcc.gov/releases/E9-1-1reconFinalPR.pdf)

Basically two technologies exist to provide the necessary Phase II data, handset-based, and network based. The FCC provided specific requirements and timetables for each. Handset-based requires that existing cell phone be replaced with new models, capable of providing ALI. Network-based works with all existing wireless phones but may provide less accuracy.

Handset-Based ALI Technology

- Begin selling and activating ALI-capable handsets no later than October 1, 2001.
- Ensure at least 25% of all new handsets activated are ALI-capable no later than December 31, 2001.
- Ensure at least 50% of all new handsets activated are ALI-capable no later than June 30, 2001.
- Ensure that 100% of all new digital handsets activated are ALI-capable no later than December 31, 2002.
- By December 31, 2005, achieve 95% penetration of ALI-capable handsets among its subscribers.
- Wireless carriers to deploy Phase II within 6 months of the request for service from the PSAP, or by October 1, 2001, whichever is later.
- Accuracy requirement: 50 meters for 67% of calls, 150 meters for 95% of calls.

Network-Based ALI Technology

- Within 6 months of the request for service from the PSAP, Carriers are to provide Phase II information to 50% of the PSAP population or coverage area.
- Within 18 months of the request, carriers must provide for 100% of the PSAP population or coverage area.
- Accuracy requirement: 100 meters for 67% of calls, 300 meters for 95% of calls.

Phase II Redefined

Due to technical challenges, the nation's largest carriers requested Phase II waivers from the FCC. Upon granting the waivers, the FCC redefined the Phase II requirements and made them specific to the technical limitations. (http://www.nena.org/Wireless9-1-1/DeployTable10-01.htm)

FCC Approved Deployment Summary Table

Carrier/Deployment	FCC	Voice-stream	Nextel	Cingular (1)	AWS (2)	Verizon	Sprint
Technology Type		GSM	IDEN	GSM	GSM	CDMA	CDMA
Solution Type		E-OTD	AGPS	E-OTD	E-OTD	AGPS/ AFLT	AGPS/ AFLT
		Handset	Handset	Handset	Handset	Handset	Handset
Handset Activation (3)							
Start date	10/1/01	Before 10/1/1	10/1/02	10/1/01		12/31/01	10/1/01
10%			12/31/02				
25%	12/31/01	Before 10/1/1		12/31/01		7/31/02	7/31/02
40%				3/31/02			
50%	6/30/02	10/1/01	12/1/03			3/31/03	
65%				6/30/02			
100%	12/31/02	3/31/02	12/1/04	9/30/02	Sold Day 1	12/31/03	12/31/02
95% Penetration	12/31/05	12/31/05	12/31/05	12/31/05		12/31/05	12/31/05
Handset 67%	50m	100m	50m	100m	100m	50m	50m
Accuracy 95%	150m	300m	150m	300m	300m	150m	150m
Accuracy Compliance Date	10/1/01	10/1/03	10/1/02	10/1/03	10/1/03	12/31/02	10/1/01
Initial Requests Deployed	Implement	All 10/01/01		12/31/02	All as	12/31/02 (4)	6/30/02
Lucent areas	10/1/01					4/1/02	5/30/02
Nortel areas	10/1/01			12/1/02		8/30/02	8/1/02
Motorola areas	10/1/01					3/1/03	
Ericson	10/1/01			12/1/02			
Network Implement Dates							
PSAP 50% (5)	10/1/01					12/31/01	
PSAP 100%	10/1/02					04/01/02 (6)	
Accuracy 67%	100m						
95%	300m						
Accuracy Compliance Date	10/1/01			10/1/03	10/1/03		
Backup Network		12/31/01		03/31/02	100% as Headset Enabled	None	
Implementation Dates				6/30/02		Given	
Backup method	None	NSS	None	NSS		EFLT	None
Backup accuracy		1000m		1000m		250-350m	

1--Cingular's network based compliance plan for their TDMA customer base was not approved. Sent to the FCC's Enforcement Bureau for enforcement and a possible consent decree.

2--AWS' network based compliance plan for their TDMA customer base was not approved. Sent to the FCC's Enforcement Bureau for enforcement and a possible consent decree.

3--A carrier will generally show compliance with an approved deployment plan by demonstrating that it has complied with the required fractional percentage figures during the period beginning at the date on which that percentage takes effect and ending at the date of the next benchmark. Thus, for the 10 percent benchmark, a Carrier would demonstrate that at least 10 percent of the new handsets it activated during the period between the effective date of that benchmark, and the effective date of the next benchmark were Phase II capable.

4--Except in markets served by Motorola switches. In those markets, Verizon must complete all valid PSAP requests received on or before 09/30/02 by 03/31/02.

5--As of October 1, 2001, within 6 months of a PSAP request, carriers employing network-based location technologies must provide Phase II information for at least 50% of the PSAP coverage area or population. Within 18 months of a PSAP request, carriers must provide PHASE II information for 100 percent of the PSAP coverage area or population. Note: for handset-based solutions, the coverage is based on percentages of handsets sold (with 25%, 50% and 100% levels, plus 95% of total customer base).

6--Verizon Wireless must employ a network based solution for 100% of St. Clair County, Illinois (St. Louis) and Lake County, Indiana (Gary-East Chicago market) by 12/31/01; and, for 100% of Cook County, Illinois (Chicago), St. Louis County, Missouri (St. Louis) and Harris County, Texas (Houston) by 04/01/02. In areas where Verizon receives a valid PSAP request where the majority of the PSAP coverage area is covered by Verizon's analog-only network, Verizon must take affirmative steps to comply with FCC rules.

7--In all markets served by Lucent and Nortel switches (on or before 04/01/02).

Introduction to GIS

A geographic information system (GIS) allows for the display of database information on a visual map. A GIS does not contain any maps or graphics, it creates maps and graphics from the information contained in the databases. GIS is not a mapping program, it is a complex mix of database management, display technology, and analysis tools that can be used to create maps. All the information in a GIS is referenced to a location. A GIS can contain images of aerial photography, photographs of homes, and floor plans of buildings, and large amounts of text and attribute information, but they are all tied into the databases by their location on the earth's surface.

GIS technology combines a powerful database with the unique ability to display the database information on a map. This ability to visualize information on a map allows quick analysis of information, which makes GIS invaluable to public safety. By referencing all the data in a GIS to a location on the earth's surface, maps can be generated and displayed, information can be visualized, and decisions can be quickly made.

GIS allows every feature on a map to be represented by points, lines, or polygons. Lines can be streets, pipelines, creeks, and railroads. Points could be fire hydrants, cell tower locations, building structures, or milepost. Polygons represent areas in a GIS. Polygons could be city boundaries, county boundaries, ESZ areas, lakes, and others.

GIS stores information about each feature in a database. Each street line has a directional, street name, type, address range, MSAG community, and other information associated with it. Every point, line, or polygon on the map is associated with a record in the geographical database. For example, each street on the map is a record in a table in the database. This allows GIS to quickly answer questions, such as:

Where is the caller located?
What police units are available in the area?
In which Emergency Service Zone is the caller located?
Who is the responding EMS agency?
Where is the nearest trauma center?
Which residents are in a flood zone?

All can be answered with GIS. Integrating the GIS into the PSAP is a powerful tool for improving response time, and locating wireless callers.

GIS can be defined as a collection of computer hardware, software, geographic data, trained personnel, and procedures designed to store, analyze, and display geographically referenced information. Not an easy definition so let's look at the five components of GIS individually. The five GIS components are data, hardware, software, personnel, and procedures. Each component is dependent upon the others to allow the GIS to be effective.

Data is an important part of GIS; it is the information on what the road is named, where an address is located, how far is the nearest fire station, or the fire response agency for that

area. GIS stores all the data in different tables. These tables can be considered a layer of information. The streets, creeks, hydrants, city boundaries, and cell tower locations are each a different layer of data.

Each layer of information can be displayed on a map, and turned on or off as needed. The GIS stores all information as a reference to the geographic location on the earth. Being able to retrieve the data based on a location, and turning on and off layers as needed, is one of the benefits of GIS over paper maps. Being able to plot the wireless call location on a map — which shows streets, addresses, ESZ areas, and city boundaries — is a PSAPs asset. The computer hardware stores the geographic data. Hardware provides a platform that allows for the accessibility of the data. It provides the video display, memory, and input / output connections to the computer. The computer hardware used in a GIS must be dependable, quick, and affordable. The increase in computer processing speed and the decrease in computing cost has allowed GIS technology to be available on every desktop. While computer hardware is an important part of a GIS, it is not the most important component. Many people become too involved with computer hardware, and overlook the much more important aspects of GIS.

GIS software allows the user to store, display, analyze, maintain, and create the data. The software resides on the computer hardware. GIS software is specifically designed to allow the user to easily acquire, display, correct, and maintain the data. Software selection plays an important part of being able to use and share information for other sources. Software designed to be integrated with your existing PSAP telephony systems leads to fewer problems, and lower cost. This will be discussed in other sections of this paper.

The most important components of a GIS are people. Trained people, who understand GIS as well as E9-1-1, play a vital role in a successful GIS. People, who create and maintain the data as well as those who use the GIS are key to successful E9-1-1 implementation. The procedures, processes, and techniques these people use in developing and using a GIS are critical to reaching an informed decision.

Introduction to Base Map Data

Location of a wireless call is reported to your PSAP in the form of a latitude/longitude coordinate pair. If displayed on your console, it would look like:

X = -072.2481 Y = +043.6758 or, Latitude: 43.6758 N Longitude: 72.2481 W
*Note: X, Y = Longitude, Latitude. X is Longitude, Y is Latitude

Not very useful in this form, is it? If not properly plotted on a map, the coordinate may be miles away from the caller. One will have little time to plot a location on a map in time of emergency. A computer using GIS technology is the only efficient means of converting the X and Y wireless call location into a meaningful location for dispatch. If the wireless call comes from a moving vehicle, a new coordinate will need to be retransmitted, or “re-bid”, every now and then. Doing this by hand is simply not an option.

To make sense of wireless ALI, the call location must be located and plotted on a map. Plotting the location, along with the existing streets and addresses, ESN boundaries, and similar "background" information, will allow the call taker to quickly determine the location of the call. The background information should include the street centerlines, railroads, water features, ESN/ESN areas, city boundaries, county boundaries, emergency service agency locations, and other information.

This background information is your "base map data", which is intended to support all wireless calls in your area. The data layers for GIS should include street centerlines, railroads, water features (lakes, streams, ponds, rivers), ESN / ESZ boundaries, city, and county boundaries, emergency services locations, and other similar types of data.

The recommended data layers of information can be found in the NENA Recommended Technical Standards, 02-010, Exhibit 22, GIS 1.0 Data Model Formats. The provides the recommended "base map data layers", which will allow you to support GIS for all wireless calls in your area. Detailed information on the GIS Data Formats is available through NENA at: (http://www.nena.org/9-1-1TechStandards/Standards_PDF/NENA%2002-010.pdf)

Acquiring Base Map Data

The good news about base map data is that you are not alone in needing it. Much of the data you will need may already be available. Most of the data you will need to deal with wireless ALI is required by many other organizations, for different applications. That means that local, regional, or state agencies may already have this information in a form you can use with the GIS software.

This means you need to take the time and contact all the agencies in the area to determine if they have any of the required data. You may be able to tap into geographic data for water features, political boundaries, road networks, and others. You may only have to create layers specific for E9-1-1, such as cell tower locations and ESN boundaries. You should always double check all data.

The greatest expense of starting a GIS operation is the collection and input of data into the system. It takes time and diligence to make sure the data in the GIS matches with your existing MSAG data. Maintaining the data is probably the next highest cost associated with a GIS. Forming partnerships with other agencies can greatly reduce the cost of obtaining and maintaining data. Forming data sharing partnerships is very cost efficient and beneficial. Data used by members of data sharing partnerships and alliances tends to be more complete, accurate, and up-to-date than any other type of data.

The most important thing to understand about GIS data for E9-1-1 is that there is no central, certified agency whose purpose is to maintain and distribute E9-1-1 capable map data sets. No matter where you get your data, **you have to assume** responsibility for the accuracy, completeness, and currency of the data. The map data must agree with the MSAG data, otherwise the ALI will not display the correct information on the visual map. Remember, when we are talking about map data, we are actually referring to a database of information that a GIS can display as a map.

The truth is, the data used for E9-1-1 must be highly accurate. No matter where you get your data, you must double-check it for accuracy and completeness. The chance of anyone's street and address data layer matching your MSAG data is very small. You will have to spend time and resources making any street and address data match your MSAG data. It is your responsibility to ensure the data is correct.

Even with the very best map data, it will never be complete. New streets are always being built, houses are being addressed, and jurisdictional boundaries will change. Someone on staff will have to be willing to make sure the new information is collected and added to the map data.

Maintenance of map data is an often overlooked and under funded expense. GIS data must be constantly maintained and updated. You would never allow your MSAG to become outdated, so you must understand that map data maintenance is also eternal.
Another often-overlooked aspect of GIS data is that you need to extend the data past your area of jurisdiction. You need to have a "buffer area" of several miles around the PSAP boundary. Wireless cell calls may come into the PSAPs from outside your boundary. The shortest path to an incident may be through an adjacent town. Wireless calls may come from a boater or hikers who are not aware of the community they are in.

Hopefully your jurisdictional area will abut with other PSAPs who are also implementing GIS, and you will be able to share data with each other. Obtaining GIS data will require coordination with agencies in, and adjacent to, your coverage area.

When selecting an integrated PSAP mapping solution, make sure you can easily import and export your data. Since this data is beneficial to so many public and private agencies, one should always strive to form partnerships and data sharing alliances for collecting and updating the GIS data.

So where does one start gathering GIS data? The best place to start looking is asking other local, regional, and state agencies if they have and maintain any GIS data. Even if they do have data, it must always be double-checked and re-checked. There are many sources of GIS data, but few meet the demands required for E9-1-1.

Base Map Data Sources

There are many places where one can obtain GIS data, each with pros and cons. One must be GIS savvy, because the buyer must always beware. It is unfortunate that many sources of GIS data, and some vendors, will try to sell data without making you aware that it is not suitable for E9-1-1. You must assume the responsibility of checking and re-checking the data for accuracy and completeness. This is why it is important to understand GIS, or to obtain the services of someone who knows GIS, 9-1-1, and that you can trust.

In 9-1-1 and public safety operations, the data used must be accurate, complete, and up-to-date. We do not have time to tell a 9-1-1 caller to hold on while we check our data, because seconds count.

Federal Government
There is a national resource of freely available GIS data from the US Census Bureau, called TIGER data. The TIGER data is created for a national demographic count of the population. It (usually) does not have enough detail to be used in 9-1-1.

The Census Bureau's "TIGER" files (http://tiger.census.gov) contains free census based data in formats that can be easily used by a GIS. The TIGER data contains information including roads, water features, railroads, boundary information, and many other layers of data. The bad news is that is inadequate for 9-1-1 uses without extensive revisions, checking, editing, and testing. The accuracy of the data is too poor for 9-1-1 uses; most of the data will have to be re-aligned, and extensively updated.

Note: The Census is embarking on a huge "TIGER Modernization" program that will raise TIGER's standards considerably and institute ongoing maintenance. As we approach the 2010 census, substantial parts of TIGER may begin to meet 9-1-1 specifications.

State Government
Many states are recognizing the value of GIS to state and municipal operations and are investing in GIS databases. A few states (Maine, Vermont, and Rhode Island) have been completely mapped to 9-1-1 standards, and many others are in process. Check with you state GIS coordinator (http://www.nsgic.org) for current status information.

These sources may have financial support, or cost sharing agreements, and certainly have opportunities for data sharing. The downside is this data probably will not agree with your MSAG, may not be available in your area, and may require some updating and editing to correct and make current.

Private Database Vendors
There are three national vendors that have various data products available. The data from these vendors will vary by vendor and your area. The best coverage is in the larger population areas, but rapidly evolving technology is improving the data. Some companies have cost benefit models that may make them attractive. The data is readily available, and some companies offer Internet based map updating. The downside may include the cost. It is always your responsibility to match their data to your MSAG, and you will be responsible for finding and correcting (or notifying the vendors to correct) errors and omissions.

Some companies limit further data distribution, which greatly limits any data sharing. Some companies require license fees and maintenance agreements, and the data may be no better than TIGER data. Other companies will go out of their way to assist you, can help with starting data sharing partnerships, and can provide technical expertise. Identify all the national vendors and determine which has the data and options that best suit your needs.

Local / Regional Government
Part, or perhaps all of your region may already be mapped in digital form by municipal or regional agencies. This is why collaboration, communication, and coordination with local and regional agencies are so important. Existing data may meet the demands of 9-1-1, with little editing or updating of the data required. The only downside is it takes a bit of effort to find the data. The benefits of data sharing and building collaborative relationships greatly

outweigh the effort required to find or start such an endeavor.

Several local governmental agencies have GIS data being used with tax appraisal, police and fire computer aided dispatching, public works, planning, and utilities management. This data may fit most of your needs, or it may need extensive updating, editing, and matching with your MSAG. It is well worth checking with all agencies to determine what is already available. These same agencies are potential data (and cost) sharing partners, so always contact them before trying to "go it alone".

Custom Data Firms

Several firms specialize in building databases for 9-1-1 and general municipal applications. Many are active members of NENA, and do a great job. It is unfortunate that many firms state they can build effective geographic data, but lack the knowledge and understanding of the high level of detail and correctness that is required for 9-1-1.

Be sure to take the time to check **all** the past customers of the data firms. Request and obtain warranties or guarantees of accuracy of the data, and examine past data products. Customer service and data integrity is more important than the lowest bid when obtaining 9-1-1 GIS data. Several firms will work very closely with you, correct and verify the data to the MSAG, and help you get started with local and regional data sharing partnerships with other entities.

Respectable custom data firms use a variety of sources and technologies to ensure accuracy. The best firms will use Global Positioning Systems (GPS) for all road centerlines (including driveways for houses not visible from the road), take photos of all structures, locate all hydrants and payphones, and verify completeness by linking to utility company records. Many will use existing orthophotography, validate against the MSAG, provide discrepancy reports, and work closely with the PSAP. With this excellent quality, you can expect to pay a premium price, but the attractiveness and detail of data makes it easier to obtain cost sharing partnerships from others who can use the data.

When selecting a consultant, follow the recommendations above, clearly define the deliverables, get everything in writing, and allow for scope changes and costs associated with those changes. If all this is properly executed, and you have checked all their references, then you should trust the consultant with the work.

Determine what the completion statistics will be when it is turned over to your agency. There must be a clear demarcation of when your agency accepts responsibility for completion of services. This is all part of the initial request for bid and contract negotiations.

Other Considerations

Remember, you are not acquiring maps; you are acquiring detailed geographic data that can be displayed as maps. Always check all references provided by vendors, and ask others within NENA if you have any questions or concerns. Many of us have, "Been there, done that, and learned this", so do not hesitate to ask. Unfortunately, you must always remember the old adage, "Let the buyer beware".

It is probably safe to state that if a potential data vendor does not know what NENA is, you

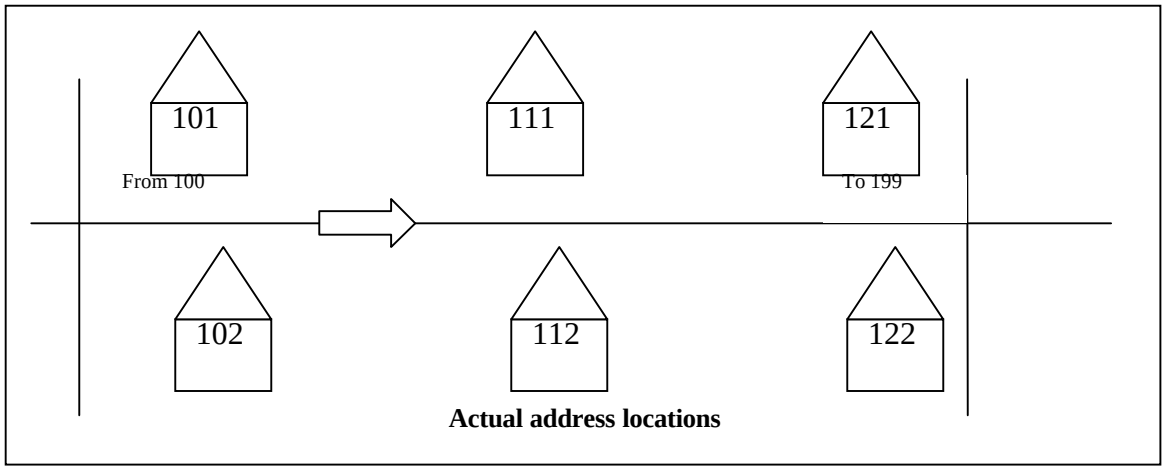
should probably keep looking for one that does. There are many firms around that say they can create street centerlines, but they often do not understand the high standards required for 9-1-1 operations.

Consider “Potential” versus “Actual” address ranges on street files. The standard practice for the past three decades in Census Bureau and Postal Service address databases has been to record the maximal “potential” address range for each street segment. In areas with one hundred block style house numbering, and in many rural areas, this method of addressing can lead to errors of many hundreds of feet. For small to medium size PSAPs, locating each structural address in your ALI database will negate this problem. For larger PSAPs, splitting arcs to match structural addressing is one way around this problem, but it makes the database much larger and difficult to correct.

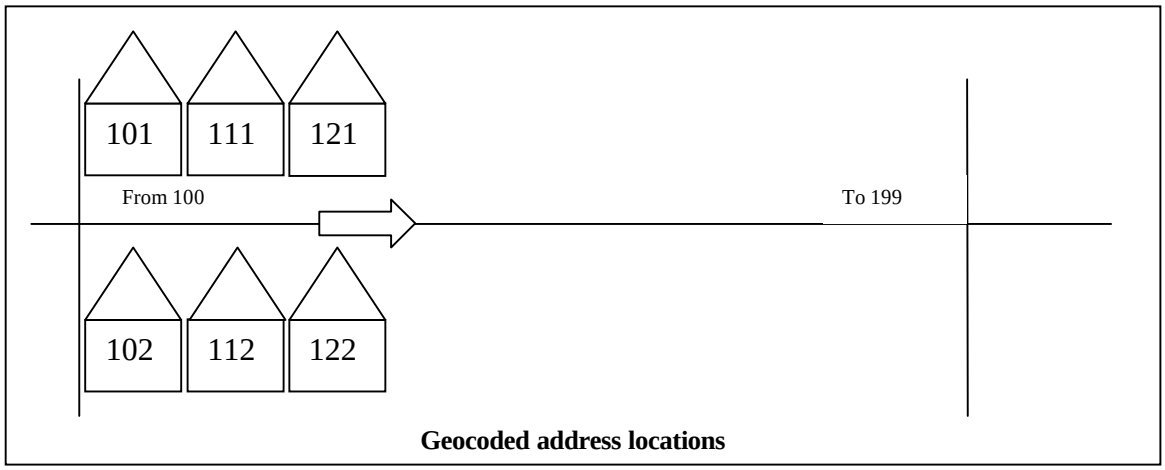
Addressing individual structures or breaking a street centerline at each addressed house, will make maintaining the data more difficult, but will remove “potential” addressing errors from the data. Some Computer Aided Dispatch systems (CAD), and other applications using the GIS data may require “potential” addressing of the street centerlines. Always coordinate with everyone who will be using the data to determine the data needs.

Geocoding is when the computer “reads” the ALI address, and plots the correct location (of the address) on the map display: Geocoding is limited due to having a linear relationship between the distance along a segment of road and the address ranges. If this requirement is not met, then geocoding will not return a valid position, which is often the case.

Consider a city block arrangement (100 block, 200 block, 300 block, etc.). Each block is assigned a 100 block range of addresses (e.g. 100-199, 200-299, etc.), regardless of the actual distance or length of the block. However, the addresses typically get assigned based on a distance from the beginning point (an intersection). As one proceeds along the road assigning addresses, the last structure will rarely match the theoretical range because of the discrepancy in the actual road segment length. For example:



If 100-199 is used as the range, all existing addresses {101, 102, 111,112, 121, 122} will geocode to the first 20% of the segment, which will produce an error of approximately 80%. If the block is 400 feet long, then the error could potentially approximate 320 feet or 100 meters!



Geocoded address locations

Use of "potential" address ranges isn't limited to Postal and Census data, commercial databases derived from either TIGER, ZIP+4, or for other considerations, may have chosen the "potential" range option.

Make sure that you know the addressing conventions in your area and are prepared to field-check and update ranges in areas with century addressing and rural roads. Some PSAPs have invested in individual address registers to avoid this problem and provide the best possible representation of address locations. Potential address ranges are fine, as long as you know the possible problems associated with them.

While it's great to have map databases as positionally accurate as possible, remember that there are limits to the accuracy of cell calls reported by either handset or network based system methodology. While current TIGER accuracy is not acceptable for 9-1-1 uses, centerlines derived from public domain DOQs (Digital Orthophoto Quads), that can be field verified to be within 7 to 10-meters, are entirely accurate enough.

The more accurate your data, the more it will cost to obtain and maintain. There is a certain cost-benefit point where it becomes too expensive to obtain higher levels of accuracy. If data sharing partners require high levels of accuracy, say for engineering applications, the savings from cost sharing may easily offset the cost of obtaining the increased accuracy. Data sharing and cost sharing lowers overall cost while improving the data quality.

Data sharing is technically in its infancy; transactional update of map databases is very rare, updating is usually done by replacement. Unless all your data-sharing partners are using the same format, or can import and export to a common format (ESRI Shapefile, AutoCad MAP, MapInfo, and Intergraph), there may be format conversion issues.

Assessing PSAP Size

Assessing the size of a Public Safety Answering Point (PSAP) can be measured using many criteria, such as call volume, number of positions, population, and number of agencies or officers the center will support. Typically the call volume the center experiences determines size of the PSAP. The larger the population the more likely higher numbers of 9-1-1 calls

will be received. Often times, the more calls received to a 9-1-1 district, the larger the number of call-taking positions, and staff to answer the calls.

Population growth of a service area could result in the need for a PSAP to increase the number of call-taking positions to handle a higher call volume, or a secondary PSAP may be an option to handle overflow during heavy calling hours.

Looking at call volume and number of call taking positions there are four sizes of PSAP: Small, Medium, Large, and Very Large. The breakdown can be calculated as follows:

Percentage of PSAP	Call Center Size	Annual Call Volume[1]	Average Number of Call Taking Positions[2]
85%	Small	10,000 - 249,999	1 - 7
10%	Medium	250,000 - 749,999	5 - 15
5%	Large	750,000 – 1,499,999	15 – 50
<1%	Very Large	1,500,000 and above	50 and above

System Capabilities (Present and Future)

What worked fine for PSAP in the past will not necessarily work today, or in the future. Technology changes very quickly, and the E9-1-1 center equipment needs to grow as the center's needs grow. Scalable systems are standard by the leading 9-1-1 customer premise equipment (CPE) vendors. With a solid E9-1-1 back room equipment foundation, the front room integrated workstations are flexible and able to add modules.

Many industry-leading vendors have worked closely with NENA, PSAPS, and E9-1-1 related agencies for years, resulting in innovative solutions to support PSAPs today and in the future. It is estimated that of the 150 million calls made to 9-1-1 in 2000, 50 million came from wireless telephone users—a ten-fold increase from nearly 4.3 million wireless 9-1-1 calls just 10 years ago—and the number of calls is expected to double to 100 million in the next five years. Locating wireless callers is the largest issue in the industry today.

Many systems across the country are being upgraded to accept the latitude and longitude coordinates being sent from the wireless carriers. How will dispatchers translate the X and Y coordinates into real world locations that can be communicated to responding agents? Thumbing through paper map books is simply not an option. Map display applications at the workstation puts the wireless caller on the map and answers the "where is the

[1] Annual incident volume is estimated at ½ the annual call volume.

[2] These numbers vary dramatically based on position types (call-taking vs. dispatching…) and staffing strategies.

emergency" question quickly, saving time and lives.

With the original FCC Phase II mandate past, proposed implementation looming, and various areas of the United States beginning to experience Phase II, the time for adding mapping to a system is now. The good news is that the advantages of bringing GIS into a PSAP go beyond caller locating. An accurate and current map and spatial database can be used by all agencies in the public safety sector to increase response efficiency. Implementing mapping and GIS within a community is advantageous for future integration with automatic vehicle location (AVL) systems for officer safety, crime and fire mapping for incident and response analysis, and in-vehicle mapping for response efficiency and even incident management once on-scene. PSAPs must look into the future, and consider that today's innovative technology such as automatic crash notification (ACN) will soon be reality. With so many uses for mapping, now and in the future, a flexible, integrated mapping application has become a required tool for call-takers, and will continue to be valuable in the call center and emergency response for years to come.

Here are some standard mapping functions that are recommended for map display applications in the call center:

Phase II wireless compatible

Single support mechanism (Both CTI & mapping—saves time/money)

CPE / IWS integration

Third party system compatibility to integrate with CAD and AVL systems

Ease of use, ease of implementation

Immediate ALI plotting on map and zoom to location

Geocoding functions should be able to handle missing addresses, alternate street names/aliases, and structure-based addressing

Identify closest intersection, landmark, or common places

Reverse geocoding for determining closest address to X, Y coordinates in ALI

Can use as many map layers as is practical without cluttering the screen

User can turn map layers on and off as desired

Pan around the map and zoom in and out

Features in map layers can be identified

Distance can be measured

Enterprise data update/synchronization solution

Uses standard data format for ease of data sharing, and availability. Map maintenance tools available

Expandable to meet your center's growing needs

Able to show pre-plans, floor plans, photograph, digital orthophotos, and site photos

System Integration

Integration of various applications and systems can be complex, and trying to make an application integrate when it is not certified to do so, can be painful and expensive. Implementing a map display component certified to co-exist with the CPE can save time, money and headaches down the line. Many times, adding mapping at the time of a CPE upgrade will significantly reduce costs compared to adding mapping after the fact, especially in the services areas. Benefits of integrating mapping on the same workstation as the computer telephony (CTI) are multifaceted.

Adding mapping to the CTI workstation ensures that all calls are mapped even if the CAD system is unavailable due to servicing or unscheduled downtime. Integrated mapping has been proven to save set up time, valuable desk space, and of course the cost of adding a stand alone PC for a non-integrated map system.

The integration of any GIS data into an existing E9-1-1 system can be a potentially sticky situation. There is a general shortage of quality GIS expertise in the CAD industry. The unfortunate result of this particular scenario is that a great many 9-1-1 agencies opt to stay with a long time CAD vendor who is attempting to write GIS software components with their CAD products. The result is that the agency remains with the vendor until the product either does not work at all, or works poorly.

The key to integrating GIS into an existing system is to find a GIS solution that is not dependent upon any particular CAD. This concept affords an E9-1-1 agency two options. One, software programs do not have to be housed under the same package; they can be implemented as separate entities that complement each other indirectly. Alternatively, find a GIS solution that can be delivered in an open format, which can be easily converted and implemented into any mapping software, whether it is mapping software a CAD vendor developed or GIS mapping software that has been developed specifically for E9-1-1.

The integration of GIS mapping into an existing E9-1-1 system can be a relatively painless experience with great benefits as long as an E9-1-1 agency does its homework and research. In any given state, ask around and find out who has been successful in integrating GIS mapping with their E9-1-1 system and who hasn't. Find out what the pitfalls and traps are to better avoid them. Find out what methods have worked well to model them. Seek out GIS talent either at the governmental level or in the private sector.

If a CAD system is present in the call center, choosing a mapping application that is flexible and can integrate with both the CTI and CAD ensures continuous availability for mapping callers and can provide the visual display of responding units on the map. Additional integration with the mapping application could consist of reverse emergency notification, 3-dimensional pictorial map application, management information systems, or call records useful for displaying where calls had come from over a period or time for analysis.

For larger call centers or multiple agencies within a 9-1-1 district, automated map distribution can optimize your workflow. The time and money spent on manually updating the workstation with map updates can be greatly reduced or eliminated with a map data distribution component. Selecting a suite of integrated mapping applications that provide

map maintenance tools, automatic map distribution utility, and the workstation map display ensures consistency, reliability, and efficiency.

When implementing mapping into a call center there are many factors to consider, such as:

? Proven record of reliability?
? Meets the standard mapping functions outlined in System Capabilities in the previous section?
? Will the mapping application reside on the same integrated workstation as the CTI ensuring reliability?
? Will my current support representative have knowledge of this added technology to ensure proper maintenance in a timely manner?
? Does the mapping vendor have 24x7 technical support and product training available?
? Can I add another monitor for fast, easy viewing of the map?
? If there is not enough desk space to add another monitor, is a single monitor adequate, and can both the map and text data be viewed on the single monitor?
? Are there additional products available and do they integrate easily for addressing, MSAG comparison, and data distribution?
? Is the product scalable to grow with my needs?
? Will the vendor be around in the future for support and upgrades?

It is also important that mapping applications meet functional standards of the call center, are user-friendly, and are able to integrate with various 9-1-1-industry tools such as CAD systems, AVL, and mobile data technologies. The mapping software should support GIS industry data standards formats, which will allow for data sharing and accessibility of quality data. Proprietary data format requirements inhibit the ability to share data with other agencies in and around your community. The first step towards implementation might be to start with your existing system vendor. See if they carry an integrated product that meets your needs.

Inter-Agency Involvement (Sharing Data and Costs)
It is important to keep in mind that the performance of any mapping application is dependent upon the completeness and accuracy of the map data. As automobiles require fuel to run the engine—you would not get too far without it—the map data is crucial to the power of the map display application. Using GIS data (base map) from your county or city GIS department, planning or assessors office is often the best approach as the level of completeness is more likely higher than from other sources, simply because of the local knowledge.

Agencies outside 9-1-1 will be extremely interested in being able to obtain highly accurate address and spatial information. The interested agencies may include the local tax appraisal district; the water and wastewater departments; the city and county engineer; city council; county commissioners; planning agencies; building code enforcement; regional and state governments; and private companies. Private companies such as the regional provider of electricity, gas, telephone, cable television, realtors, and others will benefit from having highly accurate street and address data. Talk and meet with all these agencies, the idea of sharing resources, information, and cooperative purchasing must always be considered, investigated, and fostered between agencies and organizations.

Commercial map data and services will allow those 9-1-1 call centers who do not have GIS data available from a local agency or the resources to create their own base map to jumpstart their mapping implementation. Continued maintenance on the commercial map data at the local level can help yield higher ALI hit rates.

Sharing existing map data in a standard format is one way to lower the cost of obtaining and maintaining a GIS in your agency. Multiple agencies could also pool their funds together to purchase map data, or hire a designated GIS administrator to maintain the data. Many accredited colleges and universities offer GIS courses and certificates, and could be a valuable resource for finding candidates for employment.

Resources and Training

Training of call takers is key to the successful implementation of GIS data. You can have the most complete and accurate GIS data, but if a call taker does not read the data appropriately, it can impact the handling of a 9-1-1 call. Call takers not used to working with a map will need to spend some time orienting themselves to using spatial information along with ALI. They need to acquire map-reading skills and be comfortable with the map display data. Often actually going out and "riding the streets" with a hardcopy of the map is the best way to orient a call taker to mapped data. This may not be cost efficient, but it is among the most effective.

Lesson's Learned

Follow up on the testing of new cell sites. Make sure that the correct information is displayed on the Phase 1 calls. Make sure that with the addition of the new site, the coverage did not change on a nearby site.

Know all of the players involved with the implementation. Name, Company Name, phone number, fax, and email and what part each play a role in.

Monitor the display of 9-1-1 calls. Changes occur that you might not have been told about. These changes can keep the Phase 1 or Phase II call from correctly locating on the map. On going monitoring, is often the only way you will find out if there is a problem. Train dispatch to identify a problem and work out a procedure to have it reported to you for investigation and/or correction.

Another benefit of using a GIS is the capability of being able to combine data and information from many different sources into a seamless spatial database. By collecting information from many different sources and formats, the GIS can be used to organize this disparate data into layers.

Maintaining data integrity within the GIS and keeping the data synchronized with existing tabular files, MSAG, and ALI files requires high levels of coordination. The database personnel and the GIS personnel must work closely together to resolve MSAG and GIS discrepancies.

An ongoing spirit of cooperation and coordination with other interested agencies must also be maintained. These efforts will reduce redundancy of data gathering, lower cost, improve accuracy, increase precision, and maximize resources in maintaining and updating geographic information related to public safety operations. This can also lead to synergies and accomplishments that you could not have envisioned happening.

Wireless carriers play a very important role when it comes to GIS data. PSAP jurisdictions rely on the wireless carriers or third party vendors to provide accurate and up-to-date cell tower and sector information. Again, the synchronization of both GIS and ALI databases is important. The GIS information regarding cell sector and cell site information needs to match ALI records in order for the map display to be effective. PSAP jurisdiction approval of this information is required before it is entered into the ALI database. If either the GIS or the ALI databases are not synchronized, then many "No Record Found" errors will result.

Wireless Phase II does not eliminate the need for accurate cell tower and sector information. When Phase II location cannot be provided, Phase I information is the backup. Wireless carriers need to recognize the need to provide this information and PSAP jurisdictions need to insist on accurate information from the wireless carriers.

Budget / Funding Considerations

The E9-1-1 system today requires significant ongoing and developmental funding. This section addresses two areas of interest: first, *what* must be funded for the development and maintenance of the technology components, and second, *what* potential financial sources are candidates to be pursued for funding this development. The *how* to capture this funding is left to the reader's tenacity and perseverance.

This section directs general attention to the budget considerations for the technical development of the GIS component of the PSAP/dispatch portion of the system and is not intended to address the entire range of other components. Staffing, office rental, and support cost for staff are not covered. The portion of this section addressing potential sources of funding is more general in nature and therefore more broadly applicable.

Budget Considerations

The subject of budgets requires a context (i.e., what budget?). Very broadly stated, the process starting with a 9-1-1 call and ending with the dispatch of emergency response can be considered in two parts; in the first part, the telephone company receives the call and associates it with an address and routes it to a PSAP. In the second part, the PSAP routes the call and call location to the dispatch operation to mobilize emergency service providers. As wireless E9-1-1 evolves, the "address" will become a geographic coordinate and the PSAPs must still pass the caller's location to the dispatch operation. Early "GIS" functions were as simple as having the dispatcher look up the address on a map or in the simplest system; the emergency service providers just knew where the address was and went to it. GIS technology has rapidly evolved but in many cases, this technology remains in its early evolutionary stages within the PSAP/Dispatch environment. As E9-1-1 is implemented, the GIS component of this system must become more sophisticated and budget considerations for the development of this component is the context of this section.

Although this discussion is directed at GIS development in particular, it should be noted that the listed activities could also be associated with the establishment of information technology systems in general. Each of these activities should require some degree of budget consideration. The basic activities addressed here are:

- ? Overall Requirements Definition
- ? Logical Design and Specifications
- ? Data Base Design
- ? Technology Installation
- ? Institutional Structuring and Training
- ? Data Capture and Development
- ? Application Development and Testing
- ? Production System Implementation

Overall Requirements Definition
Organizational reviews are done to establish a clear and unified understanding of the basic work process definitions and to identify the related technology requirements.

Logical Design and Specifications
Based on the requirements for the technology, a logical design is created with the focus on specifying *what* needs to be put in place. The primary foci for this design are functional definition of computer applications, core GIS and database software, computing and network hardware configurations and data specifications. This design is typically made in the context of the existing institutional structure (organization and anticipated technology users) and additionally includes a design of the staffing to oversee and operate the system.

The design is usually associated with strategic and tactical implementation plans.

Data Base Design
GIS systems are rarely installed solely for the use of emergency dispatching. The data structure consisting of street centerlines, addressing, cadastral (land survey) and property information and numerous other data sets can be and frequently are shared by other departments and agencies; indeed, the ongoing updating of nearly all of this data is rarely done by emergency dispatch personnel. Given this, the GIS is typically integrated with the emergency dispatch operations but usually maintained and operated by other agencies (typically either information technology departments or public works, engineering or planning departments).

The design of this database then becomes a much broader aspect of the establishment of this enabling technology. Data standards and sharing issues also come into play at this point.

Production System Installation
System procurement and startup includes hardware and core software purchases and system installation and testing activities. System maintenance activities also begin at this point.

Institutional Structuring and Training
A wide variety of training will be required at various points for users, management, and technical support staff. This trading must be planned in the context of the implementation activities and the organizational structure.

Data Capture and Development
Data development represents a significant aspect to the budget considerations; indeed, data capture and data maintenance efforts remain the single most significant cost of these technology implementations. Of particular interest to 9-1-1 systems is the address component of the needed data and addressing data standards particularly across shared jurisdictional boundaries, are very important in the context of this data.

Application Development and Testing
GIS technology rarely comes "out of the box". This technology is typically delivered with a wide range of capabilities that must be orchestrated into *applications* programmed and configured (*customized*) to meet the needs of the individual users of this technology. Earlier in the process, a logical design was proposed for this application development. This activity includes the translation of that logical design into a *physical* design and then the development (computer coding) and testing of these applications. These application developments must be considered as separate budget line items and typically are separate for each application developed.

Production System Implementation
The actual implementation of these systems involves linking the user agencies/departments/units work process with the technology and data. Implementation includes training of users and technicians, as well as data loading processes and a period of initial system testing.

Ongoing system and data maintenance and routine training should also be considered as separate budget line items.

On a final note, when something is problematic, budget estimates are typically too low so looking for trouble should always be a good method to uncover underestimates to budgets. A case in point here would be the subject of city/county property addressing:
Every complex system has particularly difficult aspects and the 9-1-1 systems are no exception. In terms of GIS, the data element referred to as "address" seems to evoke the most emotion in this field.

From the state level all the way down to local jurisdictions, it is rare that unified address standards have been adopted so differences between addresses provided by telephone companies and addresses used in the dispatch GIS functions are real headaches. For example, telephone company Address Location Inventories (ALIs) contain addresses that do not match address names and formats maintained by local government agencies; this creates difficulties when trying to match this address from the PSAP to a GIS address listing taken from government sources.

ALIs are essentially a listing of the telephone company's customer's addresses and, as such, are at least business proprietary so in some cases, even simple requests to have the lists reviewed to adjust for the differences with the GIS are subject to considerable resistance. It

is for these types of complicating reasons that NENA is active in the establishment of addressing standards.

Even after the considerable effort to adopt standards and bringing both data sets into synchrony, maintaining them concurrently will remain somewhat problematic and the subject of budgeted activities.

Funding mechanisms

Funding for technology developments may be available today from a number of sources. This section will review the following seven sources of funds:

- ? Federal Programs and Grants
- ? Private Grants (Foundations, Corporations and Individuals)
- ? Sales Taxes and Directed Fees
- ? Governmental Bonds
- ? Local Governmental Directed Budget line items
- ? Local Collaborative Efforts
- ? Telephone Company User Fees

This list is not all inclusive and continues to change but it represents a good starting point for those interested in researching funding mechanisms for technology growth in this field.

E9-1-1 implementation activities will require a tremendous amount of funding to come to full fruition. Of the above list of sources above it needs to be noted that far and above all others, the largest funding source today is through funds collected as user fees collected by telephone companies and passed on to local government agencies developing and maintaining 9-1-1-related technology and operations.

Federal Programs and Grants

Typically, this type of funding is available more for early adoption and innovative activities and less for established or growing programs. These funding options are less available for E9-1-1 technology development than in the mid-1990s. Nonetheless, it is worthy of consideration.

It is common for Federal grants to be contracted by local and government agencies to research for available grant monies based on needs.

To help in the research of *ongoing* funding, the federal government has the *Catalogue of Federal Domestic Assistance* (available on-line at http://www.cfda.gov/), which lists more than 1,000 existing funding programs.

For deeper research waters, one may wade into the *Federal Registry* (http://www.access.gpo.gov/su_docs/aces/aces140.html), which has literally thousands of notices. A classification exists that lists funds available by selected funding programs.

It is worth mentioning here as an example that the State of Kentucky just recently received a large grant from the Center for Disease Control to help set up a virtual Emergency Operations Center.

The issues and changing emphasis on Homeland Security need to be watched closely in anticipation of the availability of an undetermined amount of federal funds and other assistance in fields that may be useful to those organizations managing emergency response systems. It is also reasonable to assume that there could be funds coming out of the Department of Justice to support new anti-terrorist initiatives and those funds may end up spilling over into supporting enhancing the 9-1-1 system to better process reports of terrorist activities.

The federal government has a number of ongoing mapping data initiatives that provide a good foundation for information and data for maps used by GIS developers; these are not exactly a funding source but may reduce data collection funding needs by providing alternatives to map data acquisitions. The following initiatives can serve as examples of such offerings:

1. The National Map Program site at http://mapping.usgs.gov. and http://nationalmap.usgs.gov/)
2. The GeoSpatial One-Stop Web site at http://www.bts.gov/gis/geospatial_onestop/

These initiatives are primarily directed towards state and local government involvement.

Private Grants (Foundations, Corporations and Individuals)

Grants are frequently directed at modernization and an example of this type of grant is seen in West Virginia where Verizon Wireless has granted the state millions of dollars to support the development and implementation of a state wide addressing system.

State regulatory agencies sometimes work to support GIS development funding. As an example of this, the State of Texas has implemented an innovative way to enforce statewide GIS mapping and data standards. State grant funds are collected from Public Utilities Commission-authorized telephone subscriber surcharges. These grant monies are provided only to local government organizations that promise to abide by the statewide GIS mapping and data standards while using these funds.

Private or corporate grants may also become available as increased awareness of homeland security issues justifies the improvement and modernization of emergency response capabilities in selected communities.

An on-line foundation directory listing can be found and researched by going online to http://dmoz.org/Society/Organizations/Grant-Making_Foundations; a number of these foundations direct funds towards the betterment of the health and welfare of the general community.

As is the case with federal funding, a considerable amount of research is required to match available grants to identify needs and to propose appropriate grant applications.

Sales Taxes and Directed Fees

It has been reported that so-called Special Purpose Local Options Sales Taxes (requiring approval by vote) have been levied in many states (albeit the typical percentages of these types of revenue are less than five percent and much less than that specifically for

emergency response); these taxes are levied by telephone companies and directly earmarked for development or improvement of emergency services.

Local governments assess a number of development fees on developers. Some of these fees are specifically earmarked for the development of local government GIS cadastral mapping.

Governmental Bonds
Local government bonds have also been the source, in part, for technology developments. Again, this is a case where careful identification of technology needs in regard to necessary agency processes is important; a clear identification of these needs can then be made into convincing arguments for inclusion into the scope of selected bond issues.

Local Governmental Directed Budget line items
Within the budget definition process governmental budget line items are specifically directed at emergency response development, enhancement, and maintenance activities. Emergency response organizations tend to draw larger budget approvals if the operations and needs are clearly defined and measured.

Local Collaborative Efforts
A number of groups of organizations and agencies are forming to consolidate and standardize their needs for GIS and other data. In the interest of both sharing data and organizing the unified and ongoing update of that data, these groups or consortiums are frequently combining funding sources and then redirecting them to these specific goals and efforts. This consolidation concept is frequently the only way smaller governmental entities can be funded.

Telephone Company User Fees
To repeat a point made earlier, the largest funding source today is through funds collected as user fees by telephone companies and then passed on to local government agencies developing and maintaining 9-1-1-related technology and operations.
It should be noted that in some cases, these fees are directed toward the telephone company's call routing process development and maintenance, while in others, these fees may be wholly or in part directed to local emergency dispatch operations.

In a brief article, "Shirking 9-1-1 Duties" by Carl Peckinpaugh in the May 13, 2002, issue of *Federal Computer Week* magazine (p. 43), it was noted that a recent and controversial Government Accounting Office ruling has made government phone users exempt from having to pay these fees/taxes. As it turns out, this will represent a significant reduction in available funds to areas with considerable federal telephone installations (such as Washington, DC).

Conclusion

The above are only some of the challenges that PSAP will face as they address the issue of GIS data for their PSAP. The ALI Database is the original database component for Enhanced 9-1-1. Now and in the future, the GIS database will be the ALI database partner.

While maintaining ALI data accuracy, maintenance of both positional and attribute information is fundamental for a 9-1-1 GIS data set. Mechanisms need to be in place that ensures the continued accuracy and synchronization of both ALI and GIS databases.

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Toni Dunne – Positron
Kevin Graczyk - ESRI
Brant Howard – CompassCom, Inc
Doug Hurd – GDT Inc.
Ervin Kral – Las Vegas, Fire and Rescue
Kathy Lillequist – GeoComm, Inc
David Lucas – Kentucky Governors Office of Technology
Gracie Martinez - Tarrant County 9-1-1
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GIS Larry Raper – Plangraphics
Chuck Ronshagen – Plant Equipment, Inc
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Russ Steffee – Montgomery County 9-1-1
Ronald B. Smith – Calgary Police Department
Bob White – State of Maine
Rob Writz – Intrado, Inc
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Appendix 5: Wireless Technical Issues White Paper

NENA/USD0T Wireless E9-1-1 Technical Issues

Introduction

This White Paper discusses the technical issues confronting the implementation of Wireless E9-1-1 Phase II, in a sequence similar to the actual call process – from processing the 9-1-1 dialed call origination, through voice and data management and delivery, and data impacts at the PSAP. Some of the functions involved occur in parallel with others; the sequence of discussion does not necessarily indicate a serial process.

The technical issues for each call step are also defined, where applicable, at two levels: direct technical problems, and less prominent, but significant impacts on design, operations, or management of service. Preferable solutions, where known, or optional solutions are then described. These issues are discussed from the perspective of 9-1-1 public safety, and may generate other perspectives from other parties.

Wireless Number Pooling and Portability

Wireless number pooling and portability have brought a unique set of challenges to E9-1-1, particularly with delivery of the correct callback number to the PSAP.

Wireless number pooling began November 24, 2002 in most of the top 100 metropolitan areas of the United States. By the end of 2003, it will have spread across the 50 states, plus Puerto Rico and the District of Columbia. It is a number conservation method that primarily includes the assignment of numbers to telephony service providers in blocks of 1,000 rather than 10,000.

In order to implement pooling and wireless number portability (which allows customers to change service providers and retain a phone number, taking effect November 24, 2003), the wireless industry chose a procedure that separated the mobile identification number (MIN) and the mobile directory number (MDN) into two different numbers. For CDMA, TDMA and AMPS carriers, these numbers were previously identical. This permitted 9-1-1 calls to include delivery of the correct callback number without any registration processing. The MIN in the phone for a valid customer was also the callback number (MDN), therefore it could be delivered without any database table lookup or other verification.

With MIN/MDN separation, a database table lookup becomes part of the E9-1-1 process so that the correct callback number is delivered to the PSAP. This has required wireless network changes, including switch vendor and 9-1-1 third party vendor software. During the changeover, some 9-1-1 testing has been conducted utilizing various scenarios that NENA, working with various industry groups, has been involved in establishing.

Various software adjustments and settings needed to be made in certain instances so that 9-1-1 calls were routed to PSAPs correctly and the phase I and phase II E9-1-1 process worked properly to deliver the proper callback number..

As these changes have been discovered, NENA has worked with industry groups to disseminate the information and ensure that wireless carriers and their vendors nationwide could implement them and prevent any interruption or degradation to E9-1-1 service.

If a wireless carrier does not implement the appropriate MIN/MDN separation changes within its network, it is unable to deliver the correct callback number for phase I and II E9-1-1. The FCC has twice, in 2002 and 2003, issued WNP orders that have included footnotes re-affirming that wireless service providers are to deliver the correct call back number to PSAPs for a phase I/II 9-1-1 call, regardless of whether they have implemented the MIN/MDN separation compliant software changes.

It currently remains unknown how many other wireless carriers have not implemented MIN/MDN separation and are therefore unable to support roaming of pooled customers and delivery of the correct callback number to PSAPs for these customers. NENA continues to work this issue both in the technical and regulatory arenas.

In addition to MIN/MDN separation, there are other technical 9-1-1 issues related to wireless number pooling and portability.

Mixed service is when a customer has both a wireless and wireline phone active with the same phone number during the porting process (moving from one carrier to another while retaining an existing phone number). Both phones are capable of calling 9-1-1, however, only one can actually receive inbound calls. This is dependent upon certain technical steps during the porting process. This issue continues to be worked within NENA technical and operational committees with input from various industry groups and carriers.

The NENA Public Education committee has completed a consumer education project related to this mixed/dual service and the 9-1-1 limitations. The project includes a document package being distributed to wireless service providers. The package includes suggested language for handouts or other media to present 9-1-1 information to consumers who are changing service providers and retaining their phone numbers. It also includes suggested training documentation for sales associates/marketing representatives so that they can answer 9-1-1 related questions concerning the porting process. The basic consumer message is to remind customers to stay on the line when calling 9-1-1 until all the information needed has been provided to the call taker and the caller is advised that she/he can hang up. There is a brief explanation advising consumers that during the porting process interval both phones (old and new service provider's) are capable of calling 9-1-1 and being routed/answered, however, only one of the two phones can be called back by the 9-1-1 call taker. This is dependent on which industry databases have or have not yet been updated.

The entry of wireless service providers in number pooling and portability processes also impacts wireline carriers and the existing 9-1-1 ALI (automatic location identification) database, and other 9-1-1 databases. Certain database processes had been created in the late 1990s and were implemented as wireline carriers began porting and pooling.

With the advent of wireless carriers porting and pooling, these technical processes have been revisited and, where appropriate, altered to help ensure the continued integrity of these needed 9-1-1 databases. NENA committees have developed data standard changes, which have been officially approved, and these alterations have been conveyed to the appropriate industry groups for input and action.

NENA has worked and continues to work with several industry groups, which have provided assistance and input in ensuring that technical and operational 9-1-1 issues are identified and dealt with. These groups include the LNPA-WG (Local Number Portability Administration Working Group, established by the North American Numbering Council (NANC)), WNPO (Wireless Number Portability Operations team), WTSC (Wireless Testing Subcommittee), WPTF (Wireless Pooling Task Force), NNPO (National Number Portability Operations team), OBF (Ordering and Billing Forum within ATIS, Alliance for Telecommunications Industry Solutions), INC (Industry Numbering Committee also within ATIS) and others.

NSI Phones and Caller Identification

Non-service-initialized (NSI) phones are a confusing category having various 9-1-1 impacts. For some people, NSI includes phones that have never been activated for customer service. For others, NSI includes that group plus those which have been de-activated for customer service. Due to call processing technical methods and other factors, various other phone groups are included. These include (not in priority nor intended to be all-inclusive), 9-1-1 only phones, some donated phones, some prepaid phones, and international roamers.

Also included are specific 9-1-1 call types. With these types, the handset is not in any of the various groups listed above, however, because of the nature of the call type, the 9-1-1 call is processed and treated similarly to the groups listed above. These call types include (1) strongest signal, in which the 9-1-1 call is delivered on a competitor's network and so the phone itself is not registered on the appropriate network and (2) cold start, in which the phone is turned on to place a 9-1-1 call and there has been not enough time to complete the registration process.

These call types and the various groups listed earlier all comprise a category of non-registered phones at the time of a 9-1-1 call. All are treated the same within the wireless networks and processes. So, from here on, when the term NSI is used, it should be remembered that it includes all listed groups and call types, plus others. It includes

phones that have never been used for wireless service, have been used and de-activated, currently belong to valid bill-paying, 9-1-1 surcharge paying customers, and others.

This broad category continues to be debated on various levels within the industry, the PSAP community and government. It has been a topic for several months within TR45.2, ESIF (Emergency Services Interconnection Forum, co-convened by NENA and ATGIS), and NENA technical leadership/committees.

In the late 90s, TR45.2 (a standards setting group within TIA, Telecommunications Industry Association) developed a specific standard regarding delivery of a phase II E9-1-1 call (and what data is included). In that standard, there was an option for what is to be delivered as a call back number in a phase II environment. In 2002, that same group modified the standard and changed that option to a requirement forthe phase II environment.

For NSI 9-1-1 calls (which includes all phone groups listed above and all call types listed above), the call back number delivered to the PSAP as part of phase II, is 9-1-1 plus the least seven digits of the Electronic Serial Number (i.e., 911-xxx-xxxx, where x = any single digit decimal number 0-9).

Some wireless service providers are delivering the same information for NSI 9-1-1 calls in a phase I environment, others are not. There is no industry standard either requiring this or even listing it as an option as part of phase I wireless E9-1-1.

In initial very preliminary statistics-gathering by NENA, it appears that about eight per cent (8%) of wireless 9-1-1 calls fall into this category. (The statistics were gathered from four PSAPs receiving phase II calls from multiple wireless carriers. Two month totals for each were provided. Monthly percentages varied from 0% to 15% among carriers and there were some similar differences with the same carrier on a month-to-month basis. However, all 4 PSAPs had a monthly statistical average in the 8-9% range and they were in separate geographic areas of the country. Considerably more work needs to be done, gathering similar statistics from several areas of the country and more PSAPs.) This preliminary percentage is significantly high; enough to justify additional work and attention paid to this topic (NSI and 9-1-1 call delivery/processing.

There remains at least one wireless technical issue related to the delivery of 911+last 7 digits of ESN for this broad NSI category. For many of the wireless 9-1-1 calls in the above groups and types, prior to implementation of the change to 9-1-1+last 7 digits of ESN, the call back number delivered was the MIN (mobile identification number) of the caller, which could be the call back number of the current subscriber or a previous subscriber. This information could be used by a PSAP to obtain customer information (name, billing address), which could be of value in certain emergency situations or investigation of harassing/false call/fraudulent use incidences. Being able to take at least 7 digits of an ESN, along with date and time of 9-1-1 call(s) and link it to MIN so that customer (current/previous) information, if it exists, can be obtained on a timely basis, may be technically difficult for most wireless service providers.

Additional Impacts on 9-1-1 calltaker and dispatch processes

Training/education materials for PSAP personnel concerning WNP and NSI have been provided and/or are currently being created/revised within the appropriate NENA groups.

With wireless number portability, there is an increased difficulty for PSAP personnel to correctly identify which service provider to call to seek customer information (name/address) in emergency situations and/or fraudulent use incidences. Prior to number portability/pooling, the service provider relationship to a phone number could be determined by the NXX (prefix) of a number. There are various internet sites that provide this information, including NANPA (North American Numbering Plan Administration) and others. With number portability/pooling, this NXX identification is no longer valid for phone numbers that have been ported and/or pooled.

In 1998, with the advent of wireline number portability, a service was created for 9-1-1 and public safety, known as the Neustar IVR (interactive voice response unit). This service permitted PSAP personnel or other public safety/law enforcement entities to call a special number, enter a numeric password, and then enter the 10 digits of a phone number. If the number was ported and/or pooled, the response would indicate the service provider company name and a 24/7 ten digit phone number to call in order to obtain the needed customer information.

With the advent of wireless number portability/pooling and the increased implementation of phase I/II wireless E9-1-1 across the country, there is a heightened need for PSAPs to receive such information on a timely basis. PSAP education regarding this currently-free service (system paid for by the telecommunications industry and management provided by Neustar free-of-charge), has been provided and continues to be done by NENA.

However, there are needs to (1) expand the capabilities of the system and (2) provide quicker means of access to it. For (1), the current system provides information only for ported/pooled numbers, so PSAP personnel must check it and, if no response, check elsewhere for the service provider of the NXX. Combining such inquiries into one would cut minutes off of this process, and since it is used in emergency situations, shortening the time can be of critical importance. For (2), there are better and quicker methods for obtaining such information than utilizing a telephony interactive voice response unit, such as utilizing an existing, very secure national law enforcement computer system, that would cut, at minimum, several seconds from the process. It will also reduce time because it fits better in the current multi-tasking functions of most PSAPs.

This appears to require some federal intervention as to the funding of the system changes and the long-term administrative costs related to the system. This is being addressed within NENA and some federal law enforcement entities.

Call Management in the Mobile Switching Center

Congestion control in the MSC

Mobile Switching Center switches currently do not include the software features to manage congestion by limiting calls presented to the outbound network. See discussion under Network Design below. In order to provide equivalent 9-1-1 service capabilities across all 9-1-1 callers, this deficiency needs to be resolved. It would require design and development for the MSC software, which requires carrier interest in requesting these features from their switch manufacturers. This, in turn, requires that carriers recognize the need and appropriateness to support fundamental E9-1-1 service design.

Control server data completeness

When control server data bases, known as SCPs under Phase I and and MPCs in Phase II, have incomplete or inappropriate content, call routing and identification can be compromised. This involves such data factors as cell and sector ID assignments, routing definitions, class of service variations, etc. The primary resolution of these problems is based in carrier or vendor update and data management processes, supported by PSAP problem recognition and feedback. Improved and available standards, and best practices for PSAP personnel are needed to support these human processes.

Call control default assignments

Knowledge of what is involved and how to best assign default settings in the wireless 9-1-1 call environment is not well coordinated between wireless carriers/vendors and ILEC 9-1-1 system service providers. Conflicts in these settings cause inconsistency of call handling and confusion at the PSAP end of the system. Better analysis, knowledge and education for all parties are the keys to resolving this issue. This issue is currently being worked in both the NENA and ESIF groups.

Generation and Consistency of Call Related Data

Three major factors apply in this category: speed of caller location data availability, consistency/standardization of data delivery processes, and data interpretation issues.

Phase II caller location data is often not available to be delivered to the PSAP data equipment along with other 9-1-1 data, due to characteristics of the position determination equipment currently available to wireless carriers and their vendors and other related timing issues within the overall E9-1-1 systems. The percentage of Phase II calls without corresponding caller location data is not clear – reports vary from 40% to as low as 15%. In these cases, PSAP calltaker rebid after 15 seconds usually acquires the missing information. This data delay condition appears to be diminishing over time as position identification equipment and processes improve; however, more focus on improvement would be welcomed by Public Safety.

Wireless E9-1-1 data standards are incomplete, and those available are often not applied appropriately by carriers and vendors. Standards developed through 2002 were at a higher level than needed, and improvements have been reactive as individual problems were identified. NENA is attempting to coordinate needs and standards definition work through several initiatives: Phase I and II Features and Functions, Wireless ALI Content Team, and leadership of the ESIF Study Group on Wireless Standardized Messaging to the PSAP. These will lead into requirements to TR45.2, and PSAP requests for carrier and vendors to follow detailed standards, so that ALI data interpretation issues are mitigated. This will also drive improvements to ALI server data storage and delivery of complete data to the PSAP.

9-1-1 Trunking from MSC to the Selective Routing Switch

Network design – capacity

Excessive capacity is being designed into the 9-1-1 network by some carriers, and the needs of E9-1-1 service for call default control are sometimes not part of trunking design by wireless carriers. Where large scale trunk groups, often full 24 channel T1 facilities, are used to support calls for multiple Counties, normal E9-1-1 default call delivery controls are not possible. This also limits congestion control capabilities, allowing a different level of service for wireless compared to wireline calling. In cases where wireless carriers also install overflow from the MSC-SR trunk groups via call forwarding through the general dialed network, further disparities are possible. These methods seem to be driven by both lack of E9-1-1 design knowledge and incorrect interpretation of FCC mandate wording implying all calls must be delivered to the `PSAP'. [The FCC has informally clarified that this language was not meant to cause different treatment for wireless-originated 9-1-1 calls] A simple recognition that the `PSAP' referenced is the portion of the E9-1-1 system considered the financial responsibility of the Public Safety authority would clarify that the delivery requirement is to the MSC – SR trunk group connecting to the input side of the Selective Router, not the literal PSAP itself. Given that, the trunk group engineering process would fall into place and be consistent with normal E9-1-1 network engineering.

Network design – protocol

More efficient methods of 9-1-1 call delivery suggest that SS7 should be used for MSC to SR trunking, rather than the outdated CAMA type of trunking. Doing so would accomplish two major improvements; 1) call handling on the order of 2-3 seconds faster than CAMA, and 2) a more mainstreamed technology, supporting multiple data items in the SS7 signaling protocol. Many MSC switch types require a special software package to support CAMA, whereas SS7 is typically the signaling type generally used and supported for all other voice network interactions. Using SS7 thus is less expensive overall than CAMA, and better supported from a switch maintenance perspective, both by the wireless carrier and the SR switch provider.

In addition, use of SS7 will set the stage for expanded E9-1-1 data support in conjunction with the call itself. SS7 supports sending both the pANI (ESRK or ESRD) and the caller's callback number into the E9-1-1 system, for direct transmission to the PSAP CPE, allowing recovery of the PSAP's ability to do normal one-button call back functions. (This also requires that the PSAP utilize 20 digit signaling from the SR to the PSAP – Enhanced MF or higher levels of signaling protocol) This also allows the PSAP to receive the callback number with the call, so that this critical capability is once again independent of any failures in the E9-1-1 data transport process. And, as E9-1-1 evolution continues, SS7 supports the delivery of additional data items, characterized as `Essential' data in the NENA E9-1-1 Future Path Plan (ref to Future Path Plan on www.nena.org).

Congestion control impacts

Since wireless MSCs have not been designed to support congestion control, outbound trunk group sizing based on normal 9-1-1 network engineering is the available method at this time.

SR control data completeness

As wireless E9-1-1 service is implemented and maintained, the fixed data base records in the ALI/SR data bases must be complete and then consistently updated so that call routing control is accurate. When ESRK or ESRD records are incomplete, call routing is compromised and can be inaccurate, leading to calls delivered to wrong PSAPs, sometimes over large distances. The solution to this issue is largely managerial, on the part of carriers and their vendors.

9-1-1 Trunking to the PSAP

Trunk group arrangements and sizing

The lack of carrier congestion control capabilities and incorrect MSC-SR trunk group engineering, as described above, in conjunction with the threat of short term peaks of wireless 9-1-1 calling from accident scenes and other emergency cases causes PSAPs to believe that they must protect their service capabilities. The typical approach is to provide separate SR-PSAP trunk groups for wireless calls, which avoids overload of in-place trunk groups, which become dedicated to wireline call delivery. This approach causes total trunk quantity to exceed that really needed for overall call volumes, and at the same time limits trunking capacity for any given set of calls.

Call related data delivery and impacts

As E9-1-1 evolves to support new call and emergency messaging service types, call related data delivery needs suggest a more robust design. In order to restore full PSAP call handling capability, wireless calls need to be delivered across interfaces that support

at least 20 digits of signaling information. This requires Feature Group D or SS7 from the MSC to the SR in today's system architecture, and Enhanced MF from SR to PSAP. NENA believes that IP based interfaces, especially to the PSAP, are the probable future method. Standards for this need to be developed as soon as possible, and NENA has recently established a full VoIP/Packet Technical Committee to build on previous IP interface work. This Committee currently has significant involvement and commitment from individuals prominent in IP-specific standards groups.

Data delivery to the Calltaker

Expansion of delivered data due to wireless E9-1-1 feature evolution

Over the last 2-3 years, discovery of data availability and needs beyond the basic caller location latitude and longitude has occurred. Such items as calculated caller location confidence and uncertainty have driven work to determine applicability and standards detail, both among the carrier industry and vendors, and in the public safety arena. Expectations of caller speed and direction of travel data also come into play. Due to lack of pre-planning for these data areas, handling has been largely reactive, and capabilities to support delivery of added data items across the parties to wireless E9-1-1 vary greatly and have been largely reactive to date. ESIF, NENA, and TR45 group actions have been initiated to deal with this area.

Consistency of data handling

Due to lack of specific standards, and a great variation in user knowledge across the country, wireless implementations have generated variations in how wireless data is handled between different vendors and different public safety authorities. This has resulted in variations as to what data items appear in what data field, which affects how the data is displayed at the PSAP. This has driven complication and costs associated with customizing PSAP screen displays, CAD software, and mapping system software and parameters. Dealing with this situation nationally is the current objective of the NENA Wireless ALI Content Team, which will lead to more specific standards definition and implementation.

Results from NENA's Technical Development Conference/Operations Development Conference (March 2004)

NENA formed a new workgroup in its Wireless Operations Committee to address Joint Wireline/Wireless Quality Assurance. The objectives of this workgroup are to:

- Review NENA's Data Technical Committee's recommendations on standardizing best practices for MSAG maintenance
- Develop operations standards for online MSAG and ALI database updates
- Develop Operations standards for base map updates
- Develop best practices for ALI feeds (often vary by carrier)
- Examine PSAP boundary maintenance (interval use and third party use)

- Develop data maintenance related best practices related to new cell tower additions, and
- Recommend call routing administration and maintenance procedures.

Issues Identified by Emergency Services Interconnection Forum (ESIF)

1). Phase II location reliability factor. Carriers can provide a measure of the reliability of a location estimate via a data field in the Phase II message to the PSAP. How should this data be represented in the estimate? Is 90% certainty in a larger area more useful for PSAPs, or is 70% certainty in a smaller area better? The desired result is identification of a consistent, national representation of the uncertainty factor accompanying the location estimate.

2). NENA's Wireless Technical Committee also developed a recommendation regarding Type 1 trunks. It is NENA's recommendation that Type 1 trunks not be used for Phase I or Phase II wireless E9-1-1 mobile switch to selective router interconnection. It is further recommended that any Type 1 trunks currently in use for Phase I or Phase II wireless E9-1-1 mobile switch to selective router interconnection be replaced as soon as possible with CAMA, SS7, ISUP or FG-D trunks. That recommendation was developed at NENA's Annual Conference in Tampa in June 2004.

New Challenges

Next generation cell technology - here is the issue in brief:

There has been an issue lurking off the radar of public safety and even wireless carriers that affects phase 1. This issue is smart-cell technology and the implementation of next generation cell technology for both 3G and 4G needs. The impact to the 9-1-1 community at large could be huge. The essence is that phase 1 routing as we know it could become much less accurate, dramatically complicated, or made totally irrelevant at the cell sector level as we think of it today. The implications are that there is much industry and engineering work to be done to compensate for this. An example outcome could be that the cell tower is now the default level routing and not the sector. This of course opens a whole bag of worms.

Conclusions

As can be seen, there are a number of technical issues yet to be solved for Wireless E9-1-1, and more identified or on the horizon. There are a number of technical development groups involved, including NENA, TR45.2, AHES, and ESIF. Solutions are also dependent on involvement by the NENA 9-1-1 Center Operations Committee, NASNA, and APCO organizations. Better coordination of efforts, including identification and initiation of standards activities earlier, across the scope of wireless E9-1-1 functions is needed.

NENA Technical Committee structure – may be found on www.nena.org under Technical Committee

NENA Future Path Plan – may be found on www.nena.org under Technical Committee

ESIF Description – may be found at www.atis.org

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Inputs and review from:
NENA Wireless Technical Committee
Wireless Subcommittee of 9-1-1 Center Operations Committee

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Appendix 6: Accuracy Issues White Paper

Wireless Location Accuracy Issues

A White Paper Prepared for the USDOT Wireless Implementation Project

November 18, 2005

Wireless location accuracy depends largely on the capabilities of location determination technologies (LDT) used by wireless carriers to provide wireless E9-1-1 Phase II service. LDT has matured significantly, and carriers are fully utilizing several methods in the provisioning of wireless E9-1-1 Phase II. Phase II stands at about 42% deployment across the United States (as of May 2005), in terms of the number of Public Safety Answering Points (PSAPs) having at least one carrier implemented for Phase II. The present LDT methods, and several alternatives available or which may become available, are listed in Attachment A. The ability of network-based LDT technologies to achieve mandated accuracy levels is challenged in rural areas, due to the limitations in tower placement in the rural environment, and the resulting limits on triangulation capabilities.

A major question throughout the recent history of wireless E9-1-1 Phase II has been the level of accuracy being attained in the provision of the service. Associated concerns are how carriers test their networks for compliance and accuracy, how carriers report the data to show compliance, and how location information is presented to PSAPs. Consistency of location data has been and is an issue, across LDT technologies and carrier procedures. A contributing factor in this area is the lack of standards early on, and the proliferation of varying approaches that have resulted. Many PSAPs note that the differing ways location data is handled and presented is as much a problem for PSAP use as the question of accuracy levels.

Interpretation of the OET-71 accuracy testing recommendations from the FCC has been a controversial subject among wireless carriers and public safety authorities. In response to an issue presented to ESIF in 2003, a subcommittee was formed to detail the technical process involved to meet the FCC requirement for wireless accuracy compliance testing against the criteria defined in the FCC mandate and subsequent rulings. This technical methodology was based on both FCC OET-71 content and wireless carrier and vendor perspectives on appropriate methods. Public safety representatives had input to these definitions, but the subcommittee did not define policy aspects of compliance testing, such as frequency of testing, geographic area associated with the testing process, how test results would be reported, and availability of test data to public safety authorities.

In 2004, the NRIC VII advisory process to the FCC undertook the above policy issues in its Focus Group 1A. In late 2003- early 2004, FG 1A reported on negotiated agreements between the involved wireless carriers and public safety national organizations. These included proposals to set the formal compliance process as averaged results by state, along with several other interdependent agreements, including ongoing ground truth based accuracy testing during so-called maintenance testing at cell and sector levels. Two of these agreements – maintenance based accuracy testing, and uncertainty/confidence

parameters - also depended on further technical definition by ESIF. (See NRIC FG1A report content at www.nric.org) At the time of writing of this White Paper, the development by ESIF on these items of the NRIC agreements remain to be fully defined and worked, so that carriers can begin to accomplish these accuracy and data provisioning processes, and provide information to validate the levels of accuracy being attained by wireless location determination technologies.

While the NRIC FG1A agreements were not fully accepted by all Public Safety organizations, most of the involved parties appear to believe that the dialog on resolutions and enabling actions has been advanced significantly.

At this point in time, the effectiveness of LDT systems in providing call location data for wireless E9-1-1 continues to have timeliness issues. The ability of some LDT systems to identify location such that it can be available at the PSAP when the initial query for data occurs is limited. PSAPs can not be sure whether they will have accurate caller location at the appropriate point in wireless E9-1-1 call handling, and often have to re-bid one or more times to acquire true caller location data. It is presumed that the technology will continue to evolve, and reach a point where a high percentage of calls can successfully provide caller location upon initial ALI query by the PSAP equipment.

Wireless Location Determination Technologies

Present Technologies

Analysis of presently deployed technologies: The initially deployed Phase II E9-1-1 solutions fell into two basic categories: (1) GPS-based, and (2) U-TDOA (uplink TDOA). More recently, a network-based technology referred to as Wireless Location Signatures (WLS) has also been deployed. (WLS employs signal strength pattern matching of handset measurements with a geo-referenced database of the RF environment.) Generally speaking, the GPS solutions added more cost to the handsets (e.g., a GPS receiver), as well as some infrastructure cost (assist servers), but did provide the best accuracy in clear-sky scenarios (< 10m radial error). Performance was not as good in dense urban and some indoor scenarios.

Conversely, the U-TDOA and WLS solutions provided good accuracy in urban scenarios (where many base stations are used in the position determination) but do not perform as well as GPS solutions in rural scenarios. There is no cost or functionality impact to the handset for U-TDOA or WLS. The U-TDOA solutions which require an LMU (Location Measuring Unit) to be added to each cellular tower add network costs. WLS will add some infrastructure costs, but does not necessitate that hardware be added to each tower. WLS will impose drive testing costs to maintain the wireless signature database, but this could perhaps be combined with conventional drive testing used to verify cellular coverage. Neither WLS nor U-TDOA impose additional handset hardware

costs. U-TDOA will work with all legacy handsets, whereas WLS will work with legacy handsets from some, but not necessarily all, wireless technologies. This trade-off (better accuracy with modified handsets versus lower accuracy with any handset) has been

carefully considered by the Carriers and the Commission. Each technology has clear advantages and disadvantages.

Future trends for improved accuracy, GPS: for the GPS-based solutions, location accuracy is well known [14] to be < 10 m in clear sky conditions and proper GPS antenna orientation. Differential correction techniques using WAAS or locally broadcast corrections can achieve clear sky accuracies of < 3 m, by compensating the effect of ionospheric propagation delays. (Use of an L1/L2 frequency GPS receiver would be impractical and costly for a handset-based GPS receiver.) It must be noted that differential corrections would have limited benefit for weak signal/urban canyon scenarios, as the location error will be increased due to poor S/N and degraded satellite geometry, and the differential correction will not help much from a percentage error standpoint.

Going forward, new satellite navigation systems such as Galileo or the L5 channel for the US GPS system will offer somewhat higher power, e.g., by 3 dB, and this will also help improve the S/N and thus the accuracy. On the other hand, smaller handset form factors will lead to smaller GPS antennas and correspondingly lower S/N ratios for a given radiated GPS satellite power.

Future trends for improved accuracy, U-TDOA: for the U-TDOA solutions, there may be opportunities to improve S/N at the base stations. Possible methods include increased power during E9-1-1, or disabling DTX. Further details are not available at the present time.

Future trends for improved accuracy, WLS: for the WLS solution, accuracy improvements have been achieved by capitalizing on additional measurement parameters obtained by the handset or related data available in the wireless network. As the wireless standards evolve in the future, additional and more diverse data will be available that can be used by the WLS technology.

Future trends for improved robustness: this refers to the opportunity for improved location yield, i.e., getting a fix in a larger percentage of environments. For the GPS technologies, continued improvements in CMOS logic density will allow for more GPS correlators or equivalent processing hardware to be cost effectively integrated onto a GPS receiver IC. This will enable assisted GPS sensitivities to increase by 6 dB or greater (with respect to presently deployed technologies). Thus, better indoor and dense urban location coverage will be obtained for the same equivalent IC die area allocation.

[14] Kaplan et al., Understanding GPS Principles and Applications, Artech House 1996, p. 325

Going forward, combining GPS, U-TDOA or WLS with other methods described below in "New Technologies" can provide a multi-faceted solution to give outdoor and indoor coverage.

New parameters reported to PSAP: One potentially beneficial parameter is the uncertainty estimate and corresponding confidence level which can be provided on a call-by-call basis. This information can be used to notify public safety officials about the statistical accuracy of the location estimate. Currently, the uncertainty estimate and corresponding confidence level are not standardized and are not required per the FCC's mandate. This represents a potential area for improvement in the various technical forums.

Other parameters that could be provided to PSAPs are heading, velocity, and altitude. All three existing location technologies are capable of providing some level of heading/velocity information, but only the GPS based technology is capable of determining the altitude of the caller.

New technologies under development: Other location technologies either exist or are under development. Some of those are outlined and discussed briefly in this section.

E-OTD (Enhanced Observed Time Difference of Arrival) This technique employs timing-base triangulation analogous to the U-TDOA methods now deployed, except that the pseudo-ranges are measured by the handset with respect to nearby base station transmissions. Some carriers considered this approach but ultimately chose not to deploy it. Accuracy was nearly as good as U-TDOA, but since it required MS (mobile subscriber) software modifications it did not qualify as a legacy technology and thus struggled to meet the 50/150 m requirements.

RF Fingerprinting: This approach was also considered by certain carriers. One company offering it was US Wireless. It relies on Bayesian statistics to correlate a set of signal characteristics measured by "radio cameras" (i.e., hardware sensors) located at each base station with a stored set of signal characteristics in a database to determine location. Ultimately, this approach was not deployed due to the need to periodically calibrate the entire coverage area, insufficient accuracy, and the excessive cost of deploying hardware sensors and additional backhaul at every base station.

HDTV Sensors (Rosum Corporation) This scheme employs embedded HDTV receivers in the MS to decode timing sync symbols in the HDTV data header. Location Measuring Units (LMUs) must also be deployed to monitor the relative timing offsets of the different HDTV transmissions. It takes advantage of the fact that HDTV broadcast power levels are very high and thus the receiver will rarely have signal marginality issues. Accuracy has been demonstrated to be good. So far no carriers have deployed this technique, most likely due to (1) late arrival of the technology, (2) incomplete coverage in rural areas, (3) handset cost concerns. It should be noted that this approach could never provide an accurate Z-height estimate due to the nearly coplanar configuration of the HDTV towers.

WiFi Sensors: this applies to cellular phone units now under development which may also employ WLAN network functionality to provide high speed data/IP voice when the phone is in the domain of the corporate enterprise. Location inside the WLAN network can be determined by a number of different solutions provided by firms such as Ekahau or Bluesoft. This must be viewed as a potentially valuable "extension technology" to provide indoor location; it can never replace GPS, U-TDOA, or WLS solutions as a complete solution.

Appendix 7: Survey Instrument for Costs to Complete Phase II

Wireless E9-1-1 Phase II National Survey

DRAFT

Note: This document should be viewed as a final draft of survey content. (11/28/05)

This survey will be primarily telephone contact oriented. Answers will be converted to a spreadsheet for analysis. Where cost estimates are requested, these reference the estimation of the interviewed party as to ***one time capital*** *Phase II related cost.*

This survey will be mechanized by DDTI, so that answers can be summarized in an automated process.

The information from this completed survey will be used to report system requirements and cost estimates to complete Wireless E9-1-1 Phase II implementation in the United States.

Date This Survey Completed: _____

Name of NENA Surveyor _____

****

County/Parish Name _____

Jurisdiction Name (if below County level): _____

Number of Primary PSAPs Represented: _____ Total Calltaker Positions: _____

9-1-1 Director or Manager name: _____

Phone: _____ Email: _____

Contact name for technical matters: _____

Phone: _____ Email: _____

Estimated population served by the area represented in this Survey: _____

Known/estimated wireless 9-1-1 calls handled monthly: _____

Percentage of Estimated Calls handled on 9-1-1 SR – PSAP circuits: _____%

Please complete the questions below regarding the Wireless E9-1-1 Phase II capabilities within the primary set of PSAPs indicated above.

Level of 9-1-1 Service

1a How many of your PSAPs have Enhanced 9-1-1 service (both Selective Routing and ALI[1])?

Number with E9-1-1: _____ of ____ Eqpt Cost: $ _____ to complete

(Capital cost items only: Eqpt, Addressing, Network - No labor, no buildings costs

1b. Estimate percentage of population of County that has Enhanced 9-1-1 service: ___%

1c. Does your area have any Basic 9-1-1 (telephone switches direct connected to an answering point, with no Selective Routing)?

YES NO

1d Do any of the Basic 9-1-1 areas have Automatic Location Identification (ALI)?

YES NO

1e. Do you have any areas where 9-1-1 dialed calls are directed to a 10 digit, voice only telephone number?

YES NO

(If the answer to **1a** was NO, the survey is complete)

E 9-1-1 System Service Provider Status:

2 Name of current E 9-1-1 System Service Provider (operates Selective Router, usually an ILEC):

_____

2a. Name of ALI Database Operator/Provider (same, or provide Name):

_____

---

[1] Automatic Location Identification: The automatic display at the PSAP of the caller's telephone number,
the address/location of the telephone and supplementary emergency services information.

3 What are the 9-1-1 Tandem/Selective Router(s) serving your PSAPs?

Name of SR(s) _____

Location City(s): _____

Wireless E 9-1-1 Request / Deployment Status

4. Do you have legal authorization for PSAP Cost Recovery?

YES Cite reference: _____ NO

4a. If NO, indicate other source _____
(if no other source available, indicate None)

5. Please indicate total wireless carriers operating in your service territory. _____
(enter U if unknown)

6. Has Phase I been requested for the PSAPs? From how many carriers? _____
(If zero, the survey is completed.)

7 . Indicate the number of wireless carriers with Phase I deployed. _____

8. Has Phase II been requested for the PSAPs ?

YES NO

9. If Yes, please indicate your earliest request date for Phase II: _____

10. Indicate the number of wireless carriers with Phase II deployed. _____

11. If No, please indicate the reason(s) why a request has not been made:

Funding not available _____
Still in planning _____
No Project Manager _____
Equipment not available _____
Other (describe) _____

II. Computer Aided Dispatch (CAD)

12. Do the PSAPs in your area utilize CAD systems and information? If YES, how many of the total PSAPs. (If your answer is no, please continue with Q Section III.)

YES Number with CAD: ___ of ___ NO

13. Can the CAD systems support mapping functions applicable to wireless Phase II caller location display?

YES Cost Est: $_____ NO
(One time cost)

Estimated Recurring Cost: $ _____ per year
for maintenance, software licensing, etc

III. PSAP Mapping Display Systems

14. Do the PSAPs utilize Mapping Display Systems, other than CAD based? Please circle the appropriate response. (if the answer is no, the survey is complete)

YES Cost Est: $_____ NO

Estimated Recurring Cost: $ _____ per year

15. Do the Mapping Systems utilize a GIS data source not developed by the PSAP organization, such as commercial vendor, Auditor's office, County Engineer, etc?

YES Cost Est: $ _____ Source: _____ NO

Section IV Data Interface Upgrades

16. Do the ALI Servers utilized by your PSAPs have expanded ALI response format for Phase II available and enabled for your PSAPs?

Number enabled: ____ out of ____ Cost Est: $ _____ for remaining PSAPs

17. For the remaining PSAPs in 16, have you verified that your CPE vendor will be able to upgrade your 9-1-1 CPE to handle the expanded ALI format above?

YES Cost Est: $_____ NO

17b.Will your CAD vendor(s) need to update your CAD systems to handle data added in the expanded ALI response format noted above? (If CAD is not used, circle DNA)

YES Cost Est: $_____ NO DNA

18. How many of your PSAP(s) have the dynamic data interface (E2 or PAM) implemented?

Number enabled ____ of ____ Cost Est: $_____ to complete

****

Appendix 8: Results of Survey to Determine Equipment Costs

Table A - 8.1. Average Cost per county where Population is <50K

FIPS	County	State	2003 Total Population	TotalCost
01027	Clay	Alabama	14292	2000
13189	McDuffie	Georgia	21275	2200
13237	Putnam	Georgia	20186	2200
01023	Choctaw	Alabama	15995	2500
08029	Delta	Colorado	29473	3500
28163	Yazoo	Mississippi	28451	6726
28021	Claiborne	Mississippi	11868	7248
13105	Elbert	Georgia	20640	15000
20061	Geary	Kansas	27555	15000
12059	Holmes	Florida	19312	19000
01041	Crenshaw	Alabama	13695	20000
39175	Wyandot	Ohio	22894	25000
29211	Sullivan	Missouri	7239	26000
42059	Greene	Pennsylvania	40296	35000
28031	Covington	Mississippi	19766	39000
08051	Gunnison	Colorado	14763	40000
01131	Wilcox	Alabama	13191	42416
46135	Yankton	South Dakota	21816	50000
20137	Norton	Kansas	6138	50000
49043	Summit	Utah	35159	50000
28029	Copiah	Mississippi	28828	50000
39121	Noble	Ohio	14616	57000
01021	Chilton	Alabama	41148	60000
16009	Benewah	Idaho	9306	60000
08055	Huerfano	Colorado	8166	64000
39105	Meigs	Ohio	22962	65000
01091	Marengo	Alabama	22560	68000
01063	Greene	Alabama	10017	68000
01119	Sumter	Alabama	14697	68000
13123	Gilmer	Georgia	27148	70000
39131	Pike	Ohio	28235	75000
39027	Clinton	Ohio	41430	80000
55001	Adams	Wisconsin	19418	80000
46091	Marshall	South Dakota	4498	80000
40065	Jackson	Oklahoma	28413	80000
01047	Dallas	Alabama	46251	85000
13195	Madison	Georgia	26962	85000
40097	Mayes	Oklahoma	39562	85000
22011	Beauregard Parish	Louisiana	32754	90000
45005	Allendale	South Carolina	11234	93000
22025	Catahoula Parish	Louisiana	10723	100000

20069	Gray	Kansas	5905	100000
29143	New Madrid	Missouri	19587	100000
16007	Bear Lake	Idaho	6483	100000
29131	Miller	Missouri	23956	100000
29155	Pemiscot	Missouri	19790	100000
28007	Attala	Mississippi	19768	100000
28023	Clarke	Mississippi	18083	100000
40095	Marshall	Oklahoma	13671	100000
22043	Grant Parish	Louisiana	18560	100000
40077	Latimer	Oklahoma	10790	100000
40035	Craig	Oklahoma	15033	100000
28137	Tate	Mississippi	26119	100000
22119	Webster Parish	Louisiana	41099	100000
39171	Williams	Ohio	39157	120000
20039	Decatur	Kansas	3558	120000
40139	Texas	Oklahoma	20569	125000
40111	Okmulgee	Oklahoma	40008	132975
13033	Burke	Georgia	22594	135000
28077	Lawrence	Mississippi	13360	135000
55047	Green Lake	Wisconsin	19170	140000
22107	Tensas Parish	Louisiana	6743	145000
28013	Calhoun	Mississippi	15086	150000
39135	Preble	Ohio	42401	150000
13017	Ben Hill	Georgia	17511	150000
20129	Morton	Kansas	3477	150000
17189	Washington	Illinois	15175	150000
20065	Graham	Kansas	3014	150000
55033	Dunn	Wisconsin	40633	150000
01011	Bullock	Alabama	11744	153000
39123	Ottawa	Ohio	40951	154360
01037	Coosa	Alabama	12306	157000
29186	Ste. Genevieve	Missouri	18056	160000
45027	Clarendon	South Carolina	33333	160000
01065	Hale	Alabama	17391	165000
01109	Pike	Alabama	29865	165000
55011	Buffalo	Wisconsin	13920	170000
40117	Pawnee	Oklahoma	16754	171000
40005	Atoka	Oklahoma	13983	171500
29089	Howard	Missouri	10261	172000
39001	Adams	Ohio	27506	175000
01087	Macon	Alabama	24069	175000
39149	Shelby	Ohio	47983	175000
39107	Mercer	Ohio	40876	175000
28017	Chickasaw	Mississippi	19548	178000
39011	Auglaize	Ohio	46673	180000
28145	Union	Mississippi	25791	180000
20011	Bourbon	Kansas	15368	180000
39039	Defiance	Ohio	39349	188975

39065	Hardin	Ohio	31817	190000
13065	Clinch	Georgia	6939	200000
29035	Carter	Missouri	5946	200000
08115	Sedgwick	Colorado	2760	200000
01017	Chambers	Alabama	36602	200000
22027	Claiborne Parish	Louisiana	16528	200000
29065	Dent	Missouri	15019	200000
29179	Reynolds	Missouri	6691	200000
29153	Ozark	Missouri	9712	200000
29149	Oregon	Missouri	10471	200000
29185	St. Clair	Missouri	9897	200000
29195	Saline	Missouri	23687	200000
29197	Schuyler	Missouri	4145	200000
29199	Scotland	Missouri	4997	200000
29203	Shannon	Missouri	8377	200000
29217	Vernon	Missouri	20553	200000
29103	Knox	Missouri	4329	200000
29093	Iron	Missouri	10649	200000
29013	Bates	Missouri	16896	200000
29067	Douglas	Missouri	13121	200000
29227	Worth	Missouri	2363	200000
55045	Green	Wisconsin	34498	200000
46127	Union	South Dakota	13017	200000
39015	Brown	Ohio	43845	200000
38079	Rolette	North Dakota	13615	200000
29085	Hickory	Missouri	9294	200000
29009	Barry	Missouri	35222	200000
29181	Ripley	Missouri	13745	200000
29017	Bollinger	Missouri	12343	200000
29223	Wayne	Missouri	13482	200000
56045	Weston	Wyoming	6637	200000
29039	Cedar	Missouri	14022	200000
29045	Clark	Missouri	7391	200000
32011	Eureka	Nevada	1673	200000
08081	Moffat	Colorado	13480	210000
56039	Teton	Wyoming	20239	225000
13171	Lamar	Georgia	16514	225000
28129	Smith	Mississippi	16269	230000
28069	Kemper	Mississippi	10475	250000
55119	Taylor	Wisconsin	19897	250000
46065	Hughes	South Dakota	16481	250000
20187	Stanton	Kansas	2405	250000
40071	Kay	Oklahoma	48055	260000
28133	Sunflower	Mississippi	34452	270000
13039	Camden	Georgia	47567	300000
17013	Calhoun	Illinois	5058	300000
32007	Elko County	Nevada	46730	300000
16015	Boise	Idaho	7694	300000

28079	Leake	Mississippi	21181	300000
55103	Richland	Wisconsin	18000	300000
29133	Mississippi	Missouri	13293	300000
17107	Logan	Illinois	31227	310000
01035	Conecuh	Alabama	14155	320000
22075	Plaquemines Parish	Louisiana	26583	328000
29123	Madison	Missouri	11836	330000
28043	Grenada	Mississippi	23425	374000
28099	Neshoba	Mississippi	29168	400000
17065	Hamilton	Illinois	8634	400000
42065	Jefferson	Pennsylvania	45330	450000
08043	Fremont	Colorado	49718	500000
13177	Lee	Georgia	27342	500000
22013	Bienville Parish	Louisiana	15470	525000
42031	Clarion	Pennsylvania	41330	650000
42067	Juniata	Pennsylvania	22848	650000
17009	Brown	Illinois	7179	1000000
42087	Mifflin	Pennsylvania	45937	1500000

AVG COST 183042.5806

Table A – 8.2. Average Cost per county where Population is between 50K and 100K

FIPS	County	State	2003 Total Population	TotalCost
20155	Reno	Kansas	64817	42000
56021	Laramie	Wyoming	82140	45000
39141	Ross	Ohio	73410	76000
13285	Troup	Georgia	59097	90000
40037	Creek	Oklahoma	68868	90000
39043	Erie	Ohio	79264	108000
39129	Pickaway	Ohio	53025	150000
39145	Scioto	Ohio	81837	150000
39063	Hancock	Ohio	71472	150255
40119	Payne	Oklahoma	68886	171000
40101	Muskogee	Oklahoma	69634	190000
39157	Tuscarawas	Ohio	90869	208000
55111	Sauk	Wisconsin	57483	209000
13013	Barrow	Georgia	51487	220000
39081	Jefferson	Ohio	76043	229000
29021	Buchanan	Missouri	86122	280000
22057	Lafourche Parish	Louisiana	89157	300000
22113	Vermilion Parish	Louisiana	53444	350000
39005	Ashland	Ohio	52958	400000
55109	St. Croix	Wisconsin	66885	400000
42037	Columbia	Pennsylvania	63397	420000
13045	Carroll	Georgia	90914	450000
17001	Adams	Illinois	68592	500000
45059	Laurens	South Carolina	71843	500000
29051	Cole	Missouri	72309	700000
42015	Bradford	Pennsylvania	62204	800000

		AVG COST	$278,009.81

Table A – 8.3. Average Cost per county where Population is >100K

FIPS	County	State	2003 Total Population	TotalCost
22051	Jefferson Parish	Louisiana	449182	45000
13223	Paulding	Georgia	102006	86000
39113	Montgomery	Ohio	553188	120000
01073	Jefferson	Alabama	663927	126000
42075	Lebanon	Pennsylvania	119966	207000
49057	Weber	Utah	203149	240000
49049	Utah	Utah	396000	250000
42041	Cumberland	Pennsylvania	213928	287000
16027	Canyon	Idaho	143911	300000
39017	Butler	Ohio	338753	343000
39057	Greene	Ohio	148699	370000
39003	Allen	Ohio	107601	380000
17031	Cook	Illinois	5395193	400000
39151	Stark	Ohio	376148	450000
13135	Gwinnett	Georgia	676646	469570
40143	Tulsa	Oklahoma	573212	500000
42013	Blair	Pennsylvania	127273	500000
29099	Jefferson	Missouri	203560	800000
42125	Washington	Pennsylvania	200081	1500000
42085	Mercer	Pennsylvania	118614	2000000
39049	Franklin	Ohio	1075783	2500000
			AVG COST	565408.0952