FINAL REPORT

An Assessment of the Value of Location Data Delivered to PSAPs with Enhanced Wireless 911 Calls

April 2007

APCO International
Association of Public-Safety Communications Officials - International, Inc.

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Letter from the Project Chair

As Chair of APCO Project LOCATE (Locate Our Citizens At Times of Emergency), I am pleased to present to the Association of Public-Safety Communications Officials (APCO) International Board of Officers, the APCO Executive Council, and the APCO membership the Final Report of the LOCATE effort to Assess the Location Data delivered to the PSAP with Wireless Enhanced 911 (E911) calls on behalf of the Project LOCATE Team.

Using grant funding from the Public Safety Foundation of America (PSFA), tests were performed by an independent third-party contractor (RCC Consultants Inc) in seven Public Safety Answering Points (PSAPs) across the country. This collection of PSAPs offered a diversity of demographics and topography, a variety of local exchange carriers, automatic location and number identification equipment, and computer aided dispatch (CAD) systems. The purpose of this assessment conducted by public safety was to gauge the value and usability of the wireless location data which was presented to calltakers with E911 calls requiring immediate assistance. Project LOCATE believes this endeavor has produced significant information about the actual performance of the enhanced wireless systems deployed which has general impact on both deployment and quality assurance efforts by PSAPs across the country. In addition, the Project LOCATE grant activity demonstrated an urgent need to reconcile the expectations regarding perceived capability that the public and response agencies have with the more modest reality of current performance and capability.

Project LOCATE and the wireless service providers (WSPs) serving each PSAP Test Area met often to discuss the testing results, trends, anomalies, and to analyze the actual performance in light of the expectations of the public and the "common consumer-type experience." It is from these discussions with the WSPs that majority consensus was reached on many of the jointly developed Effective Practices (EPs), which are included in this Final Report. The benefits, both present and future, of the partnership developed with the WSPs demonstrates the value of having every PSAP Manager become more aware of the dynamics associated with wireless Phase II deployment and call delivery, as well as embrace, to whatever degree is feasible, an effective working relationship with the WSPs in their service area.

Overall, systems, as tested, did not perform as well as Project LOCATE had anticipated. While the FCC accuracy parameters are not currently applicable at the PSAP level, using them as a reference allowed a point of comparison for the consistency and usefulness of location data delivered on E911 calls to the selected PSAPs. How these systems actually performed was an important learning experience that had not been widely available. At the PSAP, the recognition of the degree of deviation associated with wireless location data has impact on call processing as well as dispatch capability. The degree of deviation must be understood per WSP in order to establish and assess actual capability within any service area. Since both the public and First Responders

have relied on the wireless location data for dispatch, this varied capability of the technology should be shared with the public and First Responders for more efficient call management and response. At one specific PSAP Test Area, supplemental testing, conducted after discussion with the WSPs, using a modified test plan developed with the WSP's input also produced somewhat improved results, although the results were still less than expected.

Finally, as a deliverable of this PSFA grant, public safety is now in possession of actual wireless E911 performance data, albeit a "snapshot in time only" of the deployed systems within each PSAP test area. The public belief that the ability to speak to a calltaker guarantees that useful location information is always present for dispatch purposes cannot be supported by the test results. The test project initiated meaningful discussions and multiple meetings with WSPs regarding ways to improve the usefulness and consistency of the location data delivered to the PSAP. The March draft report was reviewed and discussed with the WSPs and the Project LOCATE team considered feedback and sought to clarify portions of the text within this report.

Thanks to the PSFA Board of Directors who shared the vision of Project LOCATE and provided the financial support to obtain the results necessary to educate our membership and the public on the performance of wireless location data.

A special thank you to the PSAP Test Area Managers for their cooperation and patience.

Thanks also to the Project LOCATE Team members whose dedication and focused efforts put forth in this multi-year project has been inspiring. They consistently sought to achieve the highest standards for improving location accuracy delivered to the PSAP and the concrete data necessary to develop the EPs which will be helpful across our industry. They never wavered in their resolve to seek clarity in understanding and improvement in location accuracy delivered to the PSAP because of the importance it holds to how we do our jobs effectively for the safety of the public we serve.

Finally, a very sincere thank you and immense gratitude to the APCO Staff. Without their consistent and steady drive toward the mission, we would not have been able to achieve this final report and documented lessons for public safety managers across the country. The APCO membership is truly fortunate to have such dedicated individuals working on their behalf.

Nancy A. Pollock

Nancy A. Pollock
Chair
APCO Project LOCATE

The express purpose of this assessment conducted by public safety was to gauge the value and usability of the location data which was presented to call takers with wireless 911 calls requiring immediate assistance.

Letter from the President

Dear Colleagues:

In August 2005, the Board of Directors of the Public Safety Foundation of America (PSFA) awarded a grant to Project LOCATE to conduct independent testing of wireless location data delivered to Public Safety Answering Points (PSAPs). Project LOCATE's assessment of the wireless location data delivered to the PSAP was conducted in a manner consistent with the published Federal Communications Commission (FCC) guidelines. It was the first public safety review of wireless enhanced 911 (E911) system performance conducted at selected sites, representing a wide variety of topography and demographics across the country. The goal of the testing was to assess overall wireless system performance and the operational impact on PSAPs. Some of the issues the testing, data evaluation and wireless service provider (WSP) partnership addressed included:

- The value of the location data in terms of prompt, effective dispatch of the appropriate emergency services;
- The variables that contribute to the quality of the wireless location data presented to a PSAP when emergency calls are made from wireless devices;
- The lessons that have been learned since the deployment of Phase II wireless enhanced 911 and;
- The best practices that can be adopted to improve the effective deployment and performance monitoring of Phase II wireless enhanced 911, as well as the processing of per call wireless location data at the PSAP.

A very positive result of this project was the meaningful working partnership between APCO International, the PSAPs and the WSPs in a joint effort to improve the performance and managing the expectations about response to emergency calls from wireless telephones. Certainly, differences among the parties exist; however, the effort demonstrated by Project LOCATE showed that public safety and the WSPs share a common responsibility to improve location data delivered to the PSAP.

The Effective Practices (EPs) derived from this intense effort have significant value to PSAPs, as well as executive-level decision makers. The commitment to seek wireless deployment requires project management capability, as well as clear expectations about actual timelines and costs.

The development of equipment and software interfaces should be well understood and managed properly. The role of each partner in the effort to improve public safety services to wireless E911 callers must be recognized and executed appropriately. Local efforts to assess the performance of current and developing systems are critical to better understanding the wireless location data delivered to PSAPs. There is a continued need for education and awareness for responders, PSAP staff, and public expectations of public safety.

The APCO Project LOCATE Team has done a tremendous service to public safety through this effort. This work will continue as systems evolve and the ever-increasing number of wireless 911 calls becomes the dominant source of access to emergency services in many locations across the country.

Cordially,

President
APCO International

There is a continued need for education and awareness for responders, PSAP staff, and public expectations of public safety.

THE EVOLUTION OF WIRELESS ENHANCED 911

The prompt and effective dispatch of appropriate emergency services to any reported event is dependent upon obtaining the best location information possible from the caller. This essential element of competent dispatching must occur regardless of the technology type used to access the universal emergency number, 911. The national effort to resolve technical and operational issues raised by public safety was recognized by the Federal Communications Commission (FCC). The detailed history to meet service equivalency expectations of the public between wire line and wireless telephones, when accessing emergency services, is well documented within FCC Docket Number 94-102 and its subsequent Orders. In addition, the Network Reliability and Interoperability Council (NRIC VII) sought to supplement the record with subgroups dedicated to the issues surrounding the quality of location accuracy delivered to the Public Safety Answering Points (PSAPs) across the country.

The prompt, effective dispatch of appropriate emergency services to any reported event is dependent upon obtaining the best location information possible from the caller.

Since 1996, the FCC has taken action to improve the quality and reliability of 911 emergency services for wireless telephone users by adopting rules to govern the availability of basic 911 services and the implementation of Wireless Enhanced 911 (E911) for wireless services. The FCC's wireless 911 rulings seek to improve the reliability of E911 services and to provide emergency services personnel with wireless location data that will enable them to locate and provide assistance to wireless E911 callers more quickly. To further these goals, the agency has required wireless service providers (WSPs) to implement E911 service, subject to certain conditions and schedules. The FCC's wireless 911 rules apply to all cellular licensees, broadband Personal Communications Service (PCS) licensees, and certain Specialized Mobile Radio (SMR) licensees.

The basic 911 rules require WSPs to transmit all 911 calls to a PSAP without regard to validation procedures intended to identify and intercept calls from non-subscribers. Therefore, under the rules both subscribers and non-subscribers (non-initialized wireless telephones) can dial 911 and reach emergency assistance providers without having to prove their subscription status. Public safety has gained significant experience regarding the impact of non-initialized wireless telephone units used by domestic abuse victims and other groups who have a demonstrated need to access 911 promptly. [1]

Many wireless 911 calls are made by concerned citizens reporting traffic accidents, crimes, or other emergencies. Prompt delivery of these and other wireless 911 calls to public safety organizations benefits the public-at-large by promoting safety of life and property. In addition, recent U.S. Department of Homeland Security (DHS) grants to the American Trucking Association (ATA) have sought to expand the "surveillance and awareness" capability of these informed users of the national highway system by reporting suspicious persons and activity through wireless access to 911. Unfortunately, not every wireless 911 caller can adequately describe the location of the event, often leading to delayed responses and in rare cases, no response at all. The impact upon public safety agencies searching for such an ill-defined location results in loss of time, unavailability of emergency responders for other calls, as well as increased operational expense.

The FCC adopted additional requirements in May 1999 to improve the ability of wireless telephone users to complete wireless 911 calls. The 911 call-completion rules are intended to improve the security and safety of analog cellular users, especially in rural and suburban areas.

Under these rules, all wireless telephones manufactured for sale in the United States after February 13, 2000, capable of operating in an analog mode, including dual-mode and multi-mode, must include a special method for processing 911 calls. When a 911 call is made, the wireless telephone must override any programming that determines the handling of ordinary calls and must permit the call to be handled by any available WSP, regardless of whether the WSP is the customer's preferred WSP. Wireless

1 FCC Website Search www.fcc.gov

telephones capable of operating in analog mode must incorporate any one or more of the 911 call-system-selection processes endorsed or approved by the commission.

Phase I wireless 911 service was defined by the FCC with a requirement that as of April 1, 1998, or within six months of a request by the designated PSAP, whichever is later, covered WSPs must provide the PSAP the telephone number of the originator of a 911 call and the location of the cell site or base station receiving a 911 call. This information assists in the provision of timely emergency responses, both by providing some information about the general location from which the call is being received and by permitting calltakers to re-establish a connection with the caller if the call is disconnected.

The Phase II Wireless E911 Requirements, as ordered by the FCC, included the provision of Automatic Location Identification (ALI) as part of Phase II wireless E911 implementation beginning October 1, 2001, as detailed below. Originally, the FCC's rules envisioned that WSPs would need to deploy network-based technologies to provide ALI. Subsequently there have been significant advances in location technologies that employ new or upgraded wireless telephones. In September 1999, the FCC revised its rules to better enable WSPs to use handset-based location technologies to meet the Phase II wireless E911 requirements. In particular, the FCC established separate accuracy requirements and deployment schedules for network-based and handset-based technologies. In August 2000, the FCC made minor adjustments to the deployment schedule for handset-based technologies.

For the purposes of ALI Accuracy Standards, the FCC adopted the following revised standards for Phase II wireless E911 location accuracy and reliability:

- For handset-based solutions: 50 meters for 67 percent of calls, 150 meters for 95 percent of calls and;
- For network-based solutions: 100 meters for 67 percent of calls, 300 meters for 95 percent of calls.

The FCC further required WSPs to report their plans for implementing Phase II wireless E911, including the technology they planned to use to provide wireless location data by November 9, 2000. This report was aimed at providing information to permit planning for Phase II wireless E911 implementation by public safety organizations, equipment manufacturers, local exchange carriers, and the FCC, in order to support wireless Phase II deployment by October 1, 2001.[2]

2 Ibid

The Phase I wireless E911 requirements, as well as certain of the Phase II wireless E911 requirements, are applicable to WSPs only if the administrator of the designated PSAP has requested the service and is capable of receiving and utilizing information provided. In November 1999, the FCC revised its E911 rules to remove the prerequisite that a cost-recovery mechanism for WSPs be in place before WSPs are obligated to provide wireless E911 service, in response to a PSAP request; however, in order to make a valid request for wireless E911 service, the PSAP must have the means to cover the costs of receiving and utilizing the ALI information. The FCC's rules do not mandate any specific state action nor specify any particular mechanism for funding the technology and service capabilities necessary to enable the PSAP to make a valid service request.

The Communications and Public Safety Act of 1999, enacted October 29, 1999, was the topic of further orders by the FCC. In August 2000, the FCC adopted an order to implement the Wireless Communications and Public Safety Act of 1999 (911 Act). The purpose of the 911 Act is to enhance public safety by encouraging and facilitating the prompt deployment of a nationwide, seamless communications infrastructure for emergency services that includes wireless communications. The FCC initiated the implementation proceeding to address the provisions of the 911 Act and to fulfill the Congressional mandates set forth therein. Specifically, in the order adopted in August 2000, the FCC took the following initiatives:

- Designated 911 as the universal emergency telephone number within the United States for reporting an emergency to appropriate authorities and requesting assistance, effective August 29, 2000;
- Sought comment on appropriate transition periods for areas in which 911 is not currently in use as an emergency number, as well as

on service-area-specific circumstances and capabilities that must be addressed before WSPs can deploy 911 as the uniform emergency number and;
- Sought comment on how the FCC should facilitate states' efforts to deploy comprehensive emergency communications systems (i.e., through guidelines, meetings, or other information-sharing measures in a manner that does not impose obligations or costs on any person).[3]

The Association of Public-Safety Communications Officials (APCO) International was both a participant and monitor of this evolving effort on behalf of the thousands of PSAPs serving the wireless telephone user seeking assistance in times of crisis. From the beginning, public safety recognized the challenges presented by wireless E911 calls to PSAPs which lacked useful location information.

MISSION AND SCOPE OF THE PROJECT

APCO Project LOCATE (Locate Our Citizens At Times of Emergency) is committed to supporting deployment of wireless E911 service at every PSAP providing 911 services today. The work of Project LOCATE seeks to enhance the ability of all PSAPs to effectively receive and process wireless E911 calls for service and to reduce the delay in and possible denial of prompt dispatch of appropriate emergency services to those in crisis.

The selection of diverse wireless enhanced 911 deployment sites to be tested, the first-ever independent assessment, reflecting real life, common consumer experience, was made possible with the PSFA grant.

Project LOCATE, with a grant from the Public Safety Foundation of America (PSFA), coordinated the testing which developed a sample of wireless location data accuracy, as delivered to selected PSAPs. This was accomplished by contracting with and managing independent third-party testing, consistent with the FCC Office of Engineering and Technology (OET) Bulletin Number 71, while maintaining awareness of the Alliance for Telecommunications Industry Solutions (ATIS) 0500001 accuracy testing methodology.

There has been and continues to be a clear public expectation that the PSAP, as well as response agencies, will have consistent and accurate wireless location data delivered with all wireless E911 calls to the PSAP. The consumers of wireless service have embraced the convenience of service equivalency for voice communication and have made assumptions, many of which are incorrect, about the capability of these devices to deliver wireless location data that can effectively assist the PSAP in the dispatch of emergency services amidst a crisis event. Many callers are able to speak and upon interview by the calltaker, general location information can often be determined; however, in the instances the caller cannot speak, or is too young or impaired to speak clearly and effectively, meaningful information about their location is absent. In these cases, the usefulness of the wireless data associated with the calls becomes the critical means to assess which resources are to be dispatched. Every consumer should know that calls without adequate location data for dispatch purposes will take longer to process, leading to an extended response time from initial contact with the PSAP and, in some cases, no response until another source of location information is provided. It is clear to PSAPs across the country that callers expect the PSAP to "know my location" during a crisis. Indeed, there is little time during the call for help for the calltaker to explain accuracy compliance and testing issues. Public safety resources that may be dispatched to events with uncertain location information are essentially out-of-service during the time of the response and search for the reported event. The resultant loss of availability for other reported emergencies, turnkey costs of such responses, and general risk to public safety practitioners in response mode are collateral consequences of less-than-useful and inconsistent location data.

Project LOCATE believes the public has an expectation that wireless E911 will perform the same as enhanced wire line 911; therefore, effective wireless Phase II deployment should include both the service equivalency of access (voice) and the service equivalency of location information (data) to PSAPs. Meeting this public expectation is recognized as a challenge, however, improvements of system performance at the PSAP level are possible and should be required.

3 Ibid

Managing the expectations of PSAP staff, First Responders and the Public regarding the actual performance capability of wireless E911 systems as deployed across the nation will continue to require local action. At a minimum, every PSAP should seek to assess the actual performance of the current systems and assist consumers within the service area, to best utilize their wireless E911 access in times of crisis. The cost to test PSAP by PSAP is high; however, local agencies, in an effort to process calls for service in the most expedient and effective manner possible, find themselves in a situation which may require them to expend significant funds out of their already constrained public safety budgets in order to assess the usefulness of the data they receive on wireless calls.

Truly effective wireless deployment, which creates the assumption of service equivalency of access to emergency services, will continue to require accurate wireless location data, as defined in FCC Docket Number 94-102, as amended. The standard of location accuracy established by the FCC, as defined in FCC Docket Number 94-102, as amended, is not measured at the PSAP level by the WSP nor is it required under a current FCC consent decree (FCC 02 132 dated May 2, 2002 of Adoption of the Consent Decree network wide accuracy numbers from a set of test data weighted in accordance with OET Bulletin Number. 71.). Furthermore, the vast majority of PSAPs often have no means to assess and make adjustments for what should be known as the location accuracy deviation per PSAP based on credible performance testing.

The entire public safety community and those served each day by them are potentially affected by this effort to improve the consistency and accuracy of wireless E911 location data at the PSAP.

Project LOCATE specifically sought to move beyond the anecdotal reports and infrequently documented issues regarding the consistency and accuracy of wireless location data provided with Phase II wireless enhanced 911 calls. The selection of diverse wireless Phase II deployment sites to be tested, the first independent assessment reflecting real life, common consumer experience, was made possible with a grant from the PSFA. The testing provided valuable lessons for public safety, WSPs, and legislative/regulatory bodies. A number of variables were considered to maximize the value of the testing process and results.

Project LOCATE fully understands and acknowledges that even this ambitious testing is, in fact, only a "snapshot" of system performance across a diverse set of PSAP Test Areas on the days of the actual testing; however, the results are quantifiable and within the control of public safety for such deployment, problem resolution partnership, and public policy purposes that arise from it.

APCO, through Project LOCATE, is committed to helping PSAPs determine and understand what information they get with the wireless E911 call and to seek ways to improve the information received at the local level. Because WSPs are not required to report accuracy performance at the local PSAP level, APCO, on behalf of 15,000 public safety members across the country undertook a testing endeavor that cost our organization over $820,000 and immeasurable volunteer and staff time. APCO believed the testing effort was our responsibility to help public safety understand the performance of wireless systems and wireless location data delivered with wireless E911 calls, especially for those of our members who are not in a financial position to conduct such testing individually. One goal of Project LOCATE continues to be assisting all PSAPs in understanding the usefulness of wireless location data for effective response to emergency requests by the calling public.

Project LOCATE also recognizes the immediate need for the public, the PSAPs and the field agencies to better understand the capability and limitations of this technology. There is clearly an essential obligation to expand public education in order to manage expectations that are simply not met by the technology, as deployed in some locations. Finally, the managed approach to both consistent and more accurate wireless location data received at the PSAP must include a positive partnership with WSPs.

Project LOCATE has implemented strict controls on the initial and supplemental test data. The sharing of the wireless location data accuracy test results delivered to the PSAPs

through its independent third-party contractor was coordinated with the project's goals and objectives. Unfortunately, test data from initial, maintenance, and other accuracy testing efforts of the WSPs has not been provided to the PSAP for review or discussion in the past. The public has had no opportunity to evaluate the accuracy of the location data derived through the deployed system of their WSP. Many wireless users recall the wire line 911 service at their home, which translates the assigned telephone number to a unique, physical address. Absent any clear disclosure to the contrary, it is understandable that consumers would believe that the same is true for wireless telephone calls for assistance.

Project LOCATE has provided direct assistance to the PSAP, governing organization, Authority Having Jurisdiction (AHJ), and others in the interpretation and use of the test data, as summarized. This opportunity to work with PSAPs to better understand what data they do receive and the many variables which can contribute to its usefulness have been of great value to the individual PSAP and APCO membership in general.

In addition, understanding the data and the deployment in place by each WSP is critical and greatly improves the ability of the PSAP to identify issues, as well as potential solutions for both the short and long term. Project LOCATE has steadfastly urged PSAPs to be smart users of the deployed system, to understand what is being delivered and make the necessary, even if difficult, adjustments to expedite dispatch of emergency resources.

As a result of this grant funded activity, Project LOCATE can provide PSAP Managers with actual data and examples of such for informational purposes for inclusion within reports and presentations to executive decision-makers regarding the need for local improvements, as well as continuing dialogue with WSPs. The collateral benefit of this action is to be able to assist First Responders in recognizing the issues which impact the accuracy of wireless location data received at the PSAP on any call.

The entire public safety community and those served each day by them are potentially affected by the effort to improve the consistency and accuracy of wireless location data at the PSAP. Project LOCATE recognizes the need to manage current expectations among all users and responders. The success of such efforts can be measured in part by the improvement in understanding of current system capabilities. Support for public safety action to achieve significant performance enhancements leads to better consistency and accuracy of wireless location data delivered on every call to the PSAP.

This Project LOCATE Final Report offers PSAPs and others a number of Effective Practices (EPs), perhaps the most critical and important element to public safety as a result of this testing effort. A full review of these EPs was conducted with the WSP representatives, a small number were deemed to need more information or clarification. The remaining EPs, to which no comments or objections were made, are believed to be held in agreement between the parties. These practices are those demonstrated to add value to system deployment and upgrades within service areas. It has been the finding of Project LOCATE that partnership with all WSPs involved is critical to timely deployment, implementation, and accurate delivery of wireless E911 information.

Project LOCATE continues its work to have EPs fully endorsed by all the WSPs involved in the nationwide data assessment activity. This uniform approach to local issues reduces the need to adjust operations and service expectations by specific WSPs within the PSAP service area.

SELECTION OF PSAP TEST AREAS

Project LOCATE sought to identify representative PSAPs across the country that could serve as Project LOCATE PSAP Test Areas for the assessment of wireless location data accuracy delivered to the PSAP. In response to statements made within other forums regarding the potential for misrepresentation of wireless location data at the PSAP due to data translation of system subsets not under the control of the WSP, Project LOCATE sought to include multiple variables which are related to the quality of initial deployment, as well as the final data display at the PSAP receiving the wireless 911 call in times of crisis. In order to be considered as a PSAP Test Area for the initial project sponsored testing, the PSAP Manager/Executive had to verify and agree, in writing, to the following conditions:

- If selected, the PSAP staff, management, executive, and political leadership agree not to offer/participate in/respond to any media interactions prior to the review of the initial data with the Project LOCATE Team;
- The PSAP has obtained and verified that their executive-level management has approved their participation in this testing project and that all such records, reports, and results are open and usable by Project LOCATE for training, educational, regulatory, and legislative purposes;
- The PSAP and its executive management agree not to disclose any results until full analysis of all test data and processes has been finally completed and released by Project LOCATE;
- The PSAP has successfully been deployed at the wireless Phase II level of service for more than six months, with multiple WSPs;
- The PSAP is the primary PSAP for wireless 911 calls within the test area;
- The PSAP has Phase II wireless E911 service from any combination of Tier 1, Tier II, Tier III WSPs, but no less than a total of three deployed WSPs;
- The PSAP can provide a shapefile in electronic form describing the service area from which wireless telephone calls are received. Service area maps with current and accurate cell sites/tower sectors are required, electronic formats are preferred;
- The PSAP can provide total 911 call volume, number, and percent of which is wireless. If possible, wireless call volume by time of day, day of week, etc. Any PSAP level determination of call location source such as indoor/outdoor, WSP, call peak hours, etc., is welcome;
- The PSAP can identify any special features within the test area impacting wireless call volume or use on a regular basis (i.e., campuses, recreational sites, special events);
- The PSAP is willing to participate in this testing program, including committing adequate staff to the test call activity;
- The PSAP has the capability to record the calls, create records of such calls, and verify with normal wireless call processing mapping capability, the reported location of the caller, including "rebid" or "re-query;"
- All of such records shall be open to the Project LOCATE Team during this process and for subsequent analysis and reporting and;
- The PSAP can verify that no known network, Customer Premise Equipment (CPE), Computer Aided Dispatch (CAD), or mapping problem exists which would likely distort, modify, or delete wireless location data from being received and viewed at the PSAP.

Project LOCATE also required that each potential PSAP Test Area complete a PSAP specific survey instrument, which included:

- Name of Agency
- Address of Offices/Test Area Sites (if different)
- Contact Person
- Work telephone number
- Alternate telephone number
- Service Population
- Average shift staffing
- 911 System Service Provider
- CPE
- Telephony
- CAD
- Mapping Utilization Solution
- Average annual 911 Calls and percent wireless
- Current WSPs
- Maps of all cell sites known to contribute to wireless call volume (electronic and/or otherwise known cell sites, cell sites with sectors, etc.)
- Current assessment of accuracy from wireless devices, as provided

As Project LOCATE sought to further refine the PSAP Test Area candidates, each were requested to provide the following additional information to allow final selection to be based upon the greatest number of variables:

- Number of full time employees (FTEs)[4] = Small 1-25 Medium 26-74 Large 75+
- Primary Rural Environment is Rural, Suburban, Urban
- PSAP environment has campus, industrial complex, recreational/sports facilities
- Successfully deployed wireless Phase II with three or more Tier One WSPs
- Successfully deployed wireless Phase II with two or more Tier I, Tier II, Tier III WSPs

4 Full Time Equivalent

- Deployment involved TeleCommunication Systems Inc. (TCS) as third party entity
- Deployment involved Intrado as third party entity
- Deployment included cost recovery for PSAP and/or WSPs
- Deployment included no cost recovery for either primary party
- Deployment include a migration to cost recovery during implementation
- Deployment included the use of an integrator or consultant to manage the project

This selection effort provided Project LOCATE with final sites that allowed the testing plan to replicate average consumer expectation and use with locally available WSP-specific wireless telephone models which delivered wireless location data via multiple 911 System Service Providers, different WSPs' Third Party contractors, diverse CPE, different CAD systems, and alternate mapping software choices. These variables were further enhanced by consideration of PSAP size, daily service population and area in square miles, multiple terrain types and demographics, state or central wireless coordination, and cost recovery status.

The PSAP test areas were:
City of Palo Alto, California
Marion County, Florida
Jasper County, Missouri
Onondaga County, New York
Rowan County, North Carolina
Bexar County, Texas
City of Laramie, Wyoming

The seven sites selected for the initial phase of wireless location data accuracy as delivered to the PSAP were:

- City of Palo Alto, California
- Marion County, Florida
- Jasper County, Missouri
- Onondaga County, New York
- Rowan County, North Carolina
- Bexar County, Texas
- City of Laramie, Wyoming

The PSAP management team and staff at each of these sites were genuinely interested in participating with the understanding that this testing effort was the first of its kind conducted across the country.

The Project LOCATE Team acknowledges the PSAP professionals' attention to the necessary preparations and call-handling during the multiple days of field testing in each PSAP Test Area and would like to thank them for their cooperation and assistance.

See Appendix C002 for further details of PSAP test areas.

TESTING PROTOCOLS AND SUMMARY OF INITIAL RESULTS

The testing protocol authorized by Project LOCATE for each PSAP Test Area followed the same basic process and parameters. A Test Plan was developed per site, which was designed to achieve a 90 percent confidence level, +/- three percent margin of error, using Ordered Statistics, as defined within FCC OET Bulletin Number 71. There was not any weighting of test points or results. A total of 203 test points per PSAP Test Area were randomly created with 10 percent consisting of In-Building tests. The testing protocol required that a Wireless Accuracy Testing System, as well as Data Collection Units (DCU), be deployed during the tests. Ground truth per test point was established and data actually sent and received at the PSAP was automatically and independently collected for each test call. In addition to the normal processes and the voice contact with the on-duty calltaker. This dynamic was generally in place for 203 calls per WSP deployed system tested, per site. During some initial testing efforts, the test point was at a location from which "No Service" from the WSP was available. Project LOCATE further required that in order to best mirror consumer use and expectation for assistance during times of emergencies, random points could be used anywhere within the PSAP Service area at which service was available from the WSP which allowed a voice call to be completed. The wireless telephones used in each test area were also to be commonly available in the PSAP Service Area. Special telephones, external antennae,

battery boosters or special calling conditions were not used at the selected test points. In order to more closely duplicate the consumer experience, advance notice of the testing was not provided to any WSP.

The production of WSP reports per test area was completed according to the terms of the contract between APCO, Project LOCATE and the independent third-party contractor. The initial test protocols captured the wireless location data delivered to the PSAP when and if, the first occurrence of Class of Service (COS), Phase II wireless E911 was displayed, as was pre-Report general practice at most PSAPs. The assessment of the delivered wireless location data was based upon the array of data which demonstrated the specific results which produced the location errors as defined per location technology (Network/ Handheld Solution-GPS/AGPS). The Project LOCATE effort sought to identify at what point and percentage of the time (consistency) did each WSP actually deliver to the PSAP and the accuracy in the range defined as the parameters of each location solution (accuracy). It is recognized that at present, the FCC parameters for accuracy and consistency are not measured at the PSAP, but rather the entire WSP network with weighting allowed. This current regulatory permission, while understood, does not diminish the value of the parameters at the PSAP level for the purposes of determining how local systems actually perform and to what degree consumers and the PSAP can rely upon the wireless location data.[5]

A single report per WSP for each PSAP Test Area in which the WSP provided service was created by Project LOCATE and is provided here as a summary of the results of the initial testing experience. The per PSAP Test Area results were shared with WSPs individually, discussions of testing methodology, location of test call within the Test Area and re-bid dynamics were included. The name of the WSP has been changed to a code number on these reports.

In addition, the reports identified and tabulated the COS reported with each successful call to the PSAP, which presents an alternate view of the same call data. It should be noted that despite the efforts of all the parties, some of the wireless 911 test calls arrived at a PSAP other than the one designated as primary for the PSAP Test Area. These calls are designated as "Non-Target PSAP" calls and often affect the routing decisions based upon which tower took the call and not always from the choices made by the Primary PSAP.

The COS for this initial testing effort was generally defined as:

- WRLS – a call that usually provides no location coordinates. This type of call is also referred to as a Phase 0 call, unless coordinates of the sector or cell site are provided.
- WPH1 -– a call that provides the location of the cell site serving the wireless E911 caller's call.
- WPH2 – a call that provides latitude and longitude location coordinates of the wireless E911 caller's wireless telephone.

It was noted that in some PSAP Test Areas the COS was reported in an alternate form (i.e., WRLS was presented in lieu of WPH1).

Project LOCATE provides in this Executive Summary Report a condensed view of the actual performance per WSP, as measured at each of the PSAP Test Areas in which Phase II service was provided during the initial testing period. The test call COS as presented at the Target PSAP is provided, as well as data regarding calls that did not reach the Target PSAP. In addition, labeled as the Locn Error OET-71 Index at 67% and 95%, each chart includes the actual percentage of calls delivered to the PSAP which provided location data within the FCC parameters (67th and 95th percentile by location solution) with the required 90% level of confidence. Project LOCATE understands that the current FCC requirements for measuring compliance with these accuracy parameters is not required at the PSAP level.

The data as collected electronically during the initial testing is contained in the following charts prepared by Project LOCATE contractor, RCC Consultants, Inc. Results only for those WSPs that were common to at least two of the designated PSAP Test Areas is included.

5 If not trying to mirror the average consumer experience using wireless E911, one could delete all classes of calls that did not reach the appropriate PSAP and were not COS WPH2 - the sample set of test calls would diminish and performance of the target carrier may improve.

WIRELESS SERVICE PROVIDER – 001

PSAP TEST AREA	Bexar County	Jasper County	Marion County	Onondaga County	Palo Alto	Rowan County
Location Tech Choice	network	network	network	network	network	network
Calls: WRLS COS	4.43%	9.36%	2.96%	5.42%	11.33%	0.00%
Calls: WPH1 COS	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: WPH2 COS	89.66%	73.40%	39.41%	73.40%	45.81%	69.46%
Calls: Not WPH2	0.00%	0.00%	0.00%	0.00%	0.00%	4.93%
Locn Error OET-71 67% Index	55.00%	32.00%	24.00%	27.00%	52.00%	66.00%
Locn Error OET-71 95% Index	58.00%	39.00%	26.00%	27.00%	52.00%	72.00%
Calls: Dropped	0.00%	0.00%	1.97%	0.00%	0.49%	0.00%
Calls: Non Target PSAP	4.43%	13.30%	12.81%	11.82%	29.56%	18.23%
Calls: Poor Coverage	0.00%	0.00%	1.48%	6.90%	0.49%	0.49%
Calls: No Answer	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: No Service	0.49%	3.45%	37.44%	0.99%	11.82%	5.42%
Calls: Other	0.99%	0.49%	3.94%	1.48%	0.49%	1.48%
Total Calls	203	203	203	203	203	203

WIRELESS SERVICE PROVIDER – 002

PSAP TEST AREA	Bexar County	Laramie	Marion County	Onondaga County	Palo Alto
Location Tech Choice	handset	handset	handset	handset	handset
Calls: WRLS COS	1.97%	7.39%	3.45%	0.00%	8.87%
Calls: WPH1 COS	0.00%	0.00%	0.00%	11.33%	0.00%
Calls: WPH2 COS	91.63%	86.70%	52.22%	71.43%	38.92%
Calls: Not WPH2	0.00%	0.00%	0.00%	0.00%	0.00%
Locn Error OET-71 67% Index	67.00%	67.00%	55.00%	67.00%	67.00%
Locn Error OET-71 95% Index	90.00%	89.00%	57.00%	87.00%	80.00%
Calls: Dropped	0.00%	0.00%	1.97%	0.00%	0.00%
Calls: Non Target PSAP	3.94%	3.45%	13.79%	11.33%	39.41%
Calls: Poor Coverage	0.00%	0.49%	2.46%	3.45%	0.00%
Calls: No Answer	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: No Service	1.48%	0.99%	23.65%	1.97%	10.84%
Calls: Other	0.99%	0.99%	2.47%	0.49%	1.97%
Total Calls	203	203	203	203	203

WIRELESS SERVICE PROVIDER – 003

PSAP TEST AREA	Bexar County	Jasper County	Laramie	Marion County	Onondaga County	Palo Alto	Rowan County
Location Tech Choice	handset	handset	handset	handset	handset	handset	handset
Calls: WRLS COS	12.81%	13.79%	14.78%	1.97%	0.00%	16.75%	0.00%
Calls: WPH1 COS	0.00%	0.00%	0.00%	0.00%	15.76%	0.00%	0.00%
Calls: WPH2 COS	80.79%	71.43%	80.30%	54.68%	72.41%	34.98%	76.85%
Calls: Not WPH2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.42%
Locn Error OET-71 67% Index	44.00%	25.00%	67.00%	36.00%	67.00%	67.00%	65.00%
Locn Error OET-71 95% Index	44.00%	25.00%	95.00%	39.00%	76.00%	94.00%	69.00%
Calls: Dropped	0.00%	0.00%	0.00%	0.99%	0.00%	0.49%	0.00%
Calls: Non Target PSAP	5.91%	2.96%	2.96%	10.34%	8.87%	35.96%	12.81%
Calls: Poor Coverage	0.00%	0.00%	0.00%	1.97%	1.48%	0.00%	0.00%
Calls: No Answer	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: No Service	0.00%	9.36%	0.99%	26.60%	0.49%	11.82%	4.43%
Calls: Other	0.49%	2.46%	0.99%	3.45%	0.99%	0.00%	0.49%
Total Calls	203	203	203	203	203	203	203

WIRELESS SERVICE PROVIDER – 004

PSAP TEST AREA	Bexar County	Marion County	Onondaga County	Palo Alto	Rowan County
Location Tech Choice	handset	handset	handset	handset	handset
Calls: WRLS COS	18.72%	16.26%	0.00%	34.48%	0.00%
Calls: WPH1 COS	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: WPH2 COS	67.00%	29.06%	75.37%	27.09%	20.69%
Calls: Not WPH2	0.00%	0.00%	0.00%	0.00%	49.26%
Locn Error OET-71 67% Index	67.00%	50.00%	1.00%	67.00%	67.00%
Locn Error OET-71 95% Index	95.00%	50.00%	1.00%	71.00%	94.00%
Calls: Dropped	0.00%	1.97%	0.00%	0.00%	0.00%
Calls: Non Target PSAP	5.91%	6.40%	15.27%	26.11%	12.32%
Calls: Poor Coverage	1.48%	2.96%	7.39%	0.99%	0.00%
Calls: No Answer	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: No Service	4.93%	40.39%	0.99%	10.84%	16.75%
Calls: Other	1.97%	2.96%	0.99%	0.49%	0.99%
Total Calls	203	203	203	203	203

WIRELESS SERVICE PROVIDER – 005

PSAP TEST AREA	Bexar County	Jasper County	Marion County	Onondaga County	Palo Alto
Location Tech Choice	network	network	network	network	network
Calls: WRLS COS	2.46%	10.34%	2.96%	0.00%	12.32%
Calls: WPH1 COS	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: WPH2 COS	93.60%	63.05%	42.86%	82.27%	48.77%
Calls: Not WPH2	0.00%	0.00%	0.00%	0.00%	0.00%
Locn Error OET-71 67% Index	67.00%	45.00%	42.00%	9.00%	67.00%
Locn Error OET-71 95% Index	90.00%	50.00%	42.00%	13.00%	84.00%
Calls: Dropped	0.00%	0.00%	2.46%	0.00%	0.00%
Calls: Non Target PSAP	2.96%	15.27%	9.36%	11.82%	25.62%
Calls: Poor Coverage	0.00%	0.00%	1.48%	3.94%	0.49%
Calls: No Answer	0.00%	0.00%	0.00%	0.00%	0.00%
Calls: No Service	0.49%	9.36%	36.45%	0.99%	12.32%
Calls: Other	0.49%	1.97%	4.44%	0.99%	0.49%
Total Calls	203	203	203	203	203

WIRELESS SERVICE PROVIDER – 006

PSAP TEST AREA	Onondaga County	Rowan County
Location Tech Choice	handset	handset
Calls: WRLS COS	1.48%	0.00%
Calls: WPH1 COS	7.88%	0.00%
Calls: WPH2 COS	76.35%	18.23%
Calls: Not WPH2	0.00%	33.50%
Locn Error OET-71 67% Index	67.00%	67.00%
Locn Error OET-71 95% Index	76.00%	79.00%
Calls: Dropped	1.48%	0.00%
Calls: Non Target PSAP	9.85%	14.78%
Calls: Poor Coverage	1.48%	0.00%
Calls: No Answer	0.00%	0.00%
Calls: No Service	0.49%	32.02%
Calls: Other	0.99%	1.48%
Total Calls	203	203

WIRELESS SERVICE PROVIDER – 007

PSAP TEST AREA	Laramie	Marion County	Rowan County
Location Tech Choice	handset	handset	network
Calls: WRLS COS	1.97%	5.42%	0.00%
Calls: WPH1 COS	0.00%	0.00%	0.00%
Calls: WPH2 COS	94.09%	48.77%	54.19%
Calls: Not WPH2	0.00%	0.00%	22.66%
Locn Error OET-71 67% Index	67.00%	51.00%	67.00%
Locn Error OET-71 95% Index	91.00%	54.00%	95.00%
Calls: Dropped	0.00%	0.49%	0.00%
Calls: Non Target PSAP	2.96%	9.85%	16.26%
Calls: Poor Coverage	0.00%	0.99%	0.00%
Calls: No Answer	0.00%	0.00%	0.00%
Calls: No Service	0.99%	30.54%	6.90%
Calls: Other	0.00%	3.94%	0.00%
Total Calls	203	203	203

Project LOCATE conducted meetings with the individual WSPs for which test data was recorded at two or more PSAP Test Areas to review the results from each PSAP Test Area. These meetings also afforded an opportunity to discuss deployment decisions and issues, as well as potential ways to improve the performance of each system tested. A wide range of issues were identified which potentially contributed to these results.

...several important elements emerged that prompted the consideration and eventual commitment to conduct a series of supplemental test calls within one of the original PSAP Test Areas.

The WSPs shared with public safety a desire to make improvements in the performance of systems, which do not meet the expectation of delivering useful wireless location data to the PSAP. The results of these meetings are expanded in another section of this report. As a result of these post-test meetings, additional variables were identified that may have an impact on the quality of accuracy data delivered to the PSAP.

SUPPLEMENTAL TESTING PROTOCOLS AND SUMMARY OF RESULTS

Project LOCATE shared the initial testing results with the WSPs individually. In addition to the test data, WSPs were able to locate some data regarding the test calls from within their own systems. From those initial discussions, several important elements emerged that prompted the consideration and eventual commitment to conduct a series of supplemental test calls within one of the original PSAP Test Areas. In discussion with the WSPs, it was reported that subsequent rebids after presentation of the initial WPH2 COS would have provided improved location data information. Supplemental testing included recommendations made by the WSPs to augment the initial testing protocols when an initial WPH2 was provided. Project LOCATE did not retest the other areas and the data presented in the previous section is from the original assessment effort.

Upon the request of the WSPs, Project LOCATE notified the WSPs of the supplemental test dates, test telephone numbers, specified the rebid timer, and number of rebids to be used in the test. The supplemental test results (see chart on page 21) demonstrated that subsequent rebids could improve location information, but in some situations did not. The most significant change in test results for one WSP was the result of a network correction made by that WSP which was prompted by the initial Project LOCATE test results.

Project LOCATE and the WSPs learned the long-held premise that a call delivered to the PSAP with a COS of WPH2 was a valid representation that the latitude and longitude location coordinates of the wireless E911 caller's wireless telephone had been calculated may not be true in every case. Unique features of the deployed equipment within some areas provided only an initial location fix and, if rebids were properly used, a better wireless location data estimate might be produced at the PSAP. Also, certain deployed equipment in some areas held wireless location data from previous calls and that data might be displayed as a function of the timers on this data cache. The testing also showed that alerting the WSPs prior to the date and times of testing, as well as the telephone number of the test wireless telephone, would allow the WSPs to better track the actual call process and associated wireless location data.

Project LOCATE found that these per-element variables of deployed systems were not always known to the WSP and certainly not to the PSAP; therefore, the expectation of service capability was inconsistent with the actual ability of particular deployed area subsets to deliver the anticipated best location on the initial WPH2 delivery.

A new set of 203 test calls was generated for the selected single PSAP Test Area chosen for the supplemental testing effort. The WSPs were given due notice of the testing dates and time, including the individual wireless telephone numbers for each test wireless telephone to be used. A full round of additional test calls were made, and the calltakers were instructed to rebid even if the first delivered COS was WPH2.

The supplemental testing protocol included modifying the field-testing software to log multiple rebid results. A minimum of three WPH2

coordinates in sequence were captured to establish a trend at any one test location, each resulting in an error distance relative to the test location's ground truth coordinates.

The software was modified to allow a minimum amount of time for a WSP to recalculate a fix and deliver it to the appropriate calltaker. The logic sequence consisted of the following series of steps:

1. Initial call results in either a WPH2 or no-WPH2 class of service.
2. Request a manual rebid.
3. Initiate the rebid timer. At the 22-second interval, verification that a WPH2 call is received is requested from the calltaker.
4. If the call results in either a WPH2 or non-WPH2 class of service, a manual rebid is requested.
5. Proceed to Step 3. Stop call when three WPH2 coordinates are received.

The test data for each WSP was provided to the WSP for prompt review and correlation with their own internal analysis. A separate meeting was scheduled with each WSP to discuss the results employing their recommended steps for demonstrating improved quality of wireless location data delivered to the PSAP.

The chart below[6] shows the results of this supplemental testing effort by WSPs in the following order:

WSP	Location Technology	Data Delivered Better than FCC Parameter w/o Confidence computed	WPH2 Delivered with Initial Call	Percent of Time Location Improved with Rebid	Actual Location Performance with 90% Confidence	Results Compared with Prior Test
001	TDOA	86.38% (<300m)	93.00%	23.65%	61.00% / 64.00%	Improved
005	TDOA	87.10% (<300m)	12.99%	57.79%	55.00% / 71.00%	Improved
002	GPS/AFLT	97.88% (<150m)	25.53%	53.86%	67.00% / 92.00%	Improved
003	GPS/AFLT	72.59% (<150m)	33.33%	40.41%	28.00% / 44.00%	Degraded
004	GPS/ AGPS	99.86% (<150m)	3.45%	34.54%	67.00% / 95.00%	Improved
006	GPS/AFLT	94.11% (<150m)	20.12%	33.46%	67.00% / 86.00%	Improved

Project LOCATE and the WSPs found that during the supplemental testing, the DCU which was connected to one of the redundant ALI links and logging data as sent by the WSP had logged a number of duplicate entries. This anomaly did not occur with all WSPs, nor was the number of duplicate records consistent among those that did have such records within their data set. The impact of this still unexplained circumstance does not affect the location accuracy performance of the WSP; however, it does change the percentage of times the wireless location data improved with a rebid, which has been modified accordingly in the table on this page.

DEVELOPING A POSITIVE PARTNERSHIP TO IMPROVE SERVICES

APCO recognizes that in times of crisis, the wireless telephone caller is at that moment a customer of both the WSP and the PSAP that receives the call. In the critical moments of determining location, assessing severity, and assigning call codes and priority, there is little to be gained from trying to educate the caller at this point of contact, that their wireless telephone does not work exactly the same as their home wire line telephone. During those seconds, the PSAP has the burden of meeting the expectation of the caller in crisis. This responsibility means sending the right resources to the right location, now.

...APCO, on behalf of public safety recognizes, that working in partnership with the WSPs is the appropriate path...

Project LOCATE has a demonstrated history of working with and assisting PSAPs, Field Agencies, the FCC, NRIC, and the WSPs individually and jointly at Emergency Services Interconnection Forum (ESIF) on meeting the expectations of the public relating to effective wireless Phase II deployment.

This history has produced meaningful benefits as well as lingering frustrations; however, APCO, on behalf of public safety, recognizes that working in partnership with the WSPs is the appropriate path and, in most cases, avoiding what could become a steady stream of complaints to the Wireless Enforcement Bureau of the FCC.

6 Source of data: RCC Report, October 13, 2006 adjusted January, 2007

Project LOCATE approached this testing effort with the same hope that finally having useful location accuracy data from a diverse sample set will result in a positive partnership toward improving service to all PSAPs.

The ongoing, candid discussions between WSPs and Project LOCATE in this arena has produced an initial document of EPs, both for wireless Phase II deployment and for performance assessment of currently deployed systems.

PROJECT LOCATE EFFECTIVE PRACTICES

The Project LOCATE Team, consistent with the objectives of the PSFA Grant Award, identified the lessons learned and translated them into EPs under nine separate topical areas. PSAP managers, as well as their executive-level decision makers, will benefit from reviewing these EPs. Additional support and collaboration on the issues are available from Project LOCATE Team members and APCO staff. It is anticipated that while these EPs may be revised upon annual review, additional demonstrated EPs may be added to the appropriate categories as well.

The following abbreviations will be utilized throughout the effective practices:

- AHJ - Authority Having Jurisdiction
- PSAP - Public Safety Answering Point
- WSP - Wireless Service Provider, also known as Wireless Provider

The Effective Practice numbering scheme utilized will be:

- 3807Xx
- 38 Recognizes APCO Project 38-LOCATE as the author of the Effective Practice
- 07 Year Effective Practice was established
- X (1-9) Topical Area (TA)
- x Effective Practice within a section

The TA or Topical Area Identification Label

1. Policy Issues
2. Managing Public Expectations
3. Managing PSAP and Responder Expectations
4. Rebids / Re-Inquiry
5. Confidence and Uncertainty
6. Towers
7. Cache
8. PSAP Performance Testing
9. WSP – PSAP Area Testing

TA 1: Policy Issues

380711 The AHJ should designate a wireless 911 deployment coordinator per PSAP service area.

380712 The AHJ should consider a comprehensive effort to fully inform PSAP service area decision makers of the nature and dynamics of Wireless 911 deployment practices of the WSPs and the impact upon delivery of consistent and usable dispatch information to the PSAP.

380713 The WSPs and the AHJ within each PSAP service area should develop and maintain a documentation process which defines the roles and responsibilities of each (i.e., a simple checklist). As appropriate, the timeline of all testing activity including end-to-end assessments and processes to resolve issues related to deployment and testing efforts should be included.

380714 Each WSP and the AHJ over the PSAP(s) within any service area should define and develop in writing the process to resolve issues related to deployment and all related testing efforts. (See Also Appendix C)

380715 The AHJ and the WSPs, in order to sustain a professional partnership to achieve the optimum level of wireless E911 service, should maintain open and candid communications. The effort should include developing and maintaining current contact information for the primary contact personnel within operations and management.

380716 The AHJ should consider consistent processing of required information to develop the Memorandum of Understandings (MOUs) between all WSPs in the jurisdiction of the AHJ. (See Also Appendix C)

380717 The AHJ should be aware of any cost recovery parameters, restrictions, and requirements in their state.

TA 2: Managing Public Expectations

380721 The AHJ should document and provide (such as on the AHJ website or via brochures) the assessment of wireless E911 service performance within the AHJ service area, which might include service description by topologies, but should avoid WSP-specific detail. Since deployed systems change over time, the assessment effort should be continually reviewed and updated to identify changes in system performance.

380722 The AHJ and the WSPs should work in a collaborative manner to develop and distribute informational materials to assist consumers in understanding there may be differences between wireless E911 expectations and the actual wireless 911 service performance within the PSAP service area.

380723 The AHJ and the WSPs should jointly identify any environments which may reduce the delivery of useful location data to the PSAP and include this data on the AHJ's and WSPs' websites.

380724 The WSPs should collaborate with APCO Project LOCATE to develop and regularly update information for public outreach (i.e., a message related to non-initialized wireless telephones or donation of pre-owned wireless telephones). Jointly developed information should be posted on the APCO's and WSPs' websites for access by public policy-makers and public safety professionals.

The Project LOCATE Team, consistent with the objectives of the PSFA Grant Award, identified the lessons learned and translated them into Effective Practices under nine separate topical areas.

TA 3: Managing PSAP and Responder Expectations

380731 The AHJ should agree to a wireless ALI format.

380732 The WSP in a jurisdiction should comply with the selected ALI format.

380733 The AHJ should educate calltakers and responders that there are many variables that affect routing, COS and location data presented to the PSAP.

380734 The AHJ should educate calltakers and responders of the current FCC accuracy compliance requirements[7] are not required to be measured and reported at the PSAP level by the WSP; however, current system performance in terms of usefulness and consistency of location data delivered to the PSAP is necessary for effective dispatch of emergency services and locating the wireless caller.

7 FCC 94-102, Third Report and Order

380735 The AHJ should establish baseline performance and conduct regular assessments and comparisons to the baseline.

380736 The AHJ should educate calltakers and responders to use all available resources to validate location data presented by the WSP.

380737 The AHJ should incorporate the results of its local testing program into its PSAP training program. The training program should provide the 911 calltakers with an enhanced understanding of the strengths and weaknesses of the Phase II wireless E911 systems throughout the PSAP service areas and the operational impact on responders.

380738 The AHJ should have a formal internal process in place for timely reporting, tracking and resolution of any wireless performance anomalies.

380739 The AHJ should be aware of ATIS 05000010 (Maintenance Testing) troubleshooting parameters and make them part of the AHJ formal internal process.

TA 4: Rebids / Re-Query

380741 The AHJ should not rebid (automatically or manually) less than 30 seconds after the call is first presented to the calltaker. Any subsequent rebids should be at 30-second intervals. If automatic rebid is used, only the first rebid should be automatic.

380742 The AHJ should educate the calltakers that when rebids are implemented, a momentary intermittent disruption of the voice path may occur in some cases (also known as "audio blanking"). The calltaker should advise the wireless caller and instruct them not to end the wireless telephone call and stay on the line.

380743 The AHJ should rebid all wireless calls when the wireless caller is not able to provide a location, even if the call is initially presented to the calltaker as a WPH2.

380744 Each WSP should provide the AHJ with the current definition of quick fix/pre-fix or similar process if used to initially route a call.

380745 The AHJ should be aware that the exact same latitude and longitude presented after multiple rebids indicates improved location is not available. When rebidding, the calltaker would normally expect a change in latitude/longitude. The calltaker should check the COS, if it is WPH2 and it continues to be the same latitude/longitude, a note should be made of the information and then referred to the WSP. (See Also Appendix A)

TA 5: Confidence and Uncertainty

Definitions

Confidence: Information identifying the confidence by which it is known that the calling party lies within the associated shape description; expressed as percentage.

Uncertainty: Information that indicates the level of uncertainty inherent to the associated longitude/latitude information; expressed in meters.

380751 The WSP should fix the confidence value in the location-determining algorithm at a value greater or equal to 90 percent and vary the uncertainty value. This value may change over time as more research and understanding of networks are conducted and analyzed. See Also Appendix A

380752 The AHJ and the PSAP(s) should jointly decide on the display/usage of the confidence value in order to specify to the WSP the suppression (or sending) the confidence value to the PSAP. It is recommended that the confidence value be suppressed and not displayed.

380753 The WSP should deliver an uncertainty value to the PSAP along with the location information on all WPH2 calls.

380754 APCO and the WSPs should seek to define uncertainty value thresholds/trends in order to provide PSAPs with guidelines for additional (two or more) rebids.

TA 6: Towers

380761 The WSP should secure and provide to the AHJ an MSAG valid address for all towers within and adjacent to the service area of the AHJ for wireless E911 systems. The AHJ should verify the tower address provided by the WSP is MSAG valid and reply to the WSP in a timely manner.

380762 The WSP should provide the AHJ with sector identification on the towers (such as east, west, north, south, southeast, etc). Omni-directional towers should be so identified.

380763 The appropriate AHJ(s) shall define and provide routing instructions to the WSP for all tower sites and default PSAP(s) within an agreed time frame. (See Also Appendix A, ESIF Issues 35 and 36 at www.atis.org)

380764 The WSP should provide contact information to the AHJ prior to any new tower being placed into service for testing. The AHJ should compile contact information and provide it to the appropriate operations staff. The AHJ should keep contact information lists current as information is provided by the WSP.

380765 The AHJ should establish a productive working relationship with WSP representatives responsible for implementation and maintenance. The WSP should provide the current appropriate representatives' contact information to the AHJ.

380766 The WSP and the AHJ should collaborate on a data and routing maintenance process and commit to continual review with associated follow-up. (See Also Appendix A, ATIS 05000010 (Maintenance Testing) and ESIF Issues 35 and 36 at www.atis.org)

380767 The AHJ and the WSP should collaborate on a process for the reconciliation of identified misrouted wireless E911 calls and other system anomalies.

380768 The AHJ should request cell and routing data in the Mobile Positioning Center (MPC) or Gateway Mobile Location Center (GMLC) for their service area and perform annual reviews. Upon completion, results should be furnished to the WSP for their review.

TA 7: Cache

380771 The AHJ should be aware that cache has an operational impact on the accuracy of the wireless location data delivered.

380772 The WSP should provide to the AHJ an engineering description of cache sufficient to allow the AHJ to determine the operational impact within the jurisdiction.

TA 8: PSAP Performance Testing

380781 The AHJ should (in an effort to better understand any potential disparity caused by multiple factors throughout its service area) implement a program to test the performance of the WPH2 systems to include routing, usable data presented at the PSAP, and location performance in the various topologies in the PSAP Service area.

380782 The AHJ should communicate with the WSP to inform the WSP of testing to be conducted, the methodology to be utilized, and the specifics of the service deployed in the service area.

380783 The AHJ and the WSP should discuss specific testing methods and expectations for each location technology (i.e., testing in moving vehicles, indoor testing, rural versus urban, etc.).

380784 Both the AHJ and the WSP should work together to interpret the testing results and agree on a plan to address identified deficiencies to ensure that the system is performing as optimally as possible in the service area. Correction plans should

include retesting to allow assessment of improvements in system optimization.

380785 The AHJ should incorporate the results of its local testing program into its PSAP training program.

TA 9: WSP – PSAP Area Testing

380791 If call through performance testing to the PSAP will be conducted, the WSP should provide a mutually agreed upon notification to the AHJ prior to any testing in its jurisdiction.

380792 Compliance accuracy testing methodology used by the AHJ or the WSP should fall within the guidelines set forth in OET-71 or ATIS 0500001 (Accuracy Testing).

380793 During the call through performance testing to the PSAP testing process, the AHJ should monitor the process to ensure there is consistency between the pANI[8] sent by the WSP and the information displayed at the PSAP.

380794 Call through performance testing to the PSAP testing should be designed in such a way to validate routing and delivery of format and content of ALI display at the PSAP as defined by the AHJ.

380795 The WSP and the AHJ should mutually agree to an end-to-end field-testing schedule to minimize the impact of and disruption to the PSAP operations.

380796 The WSP and the PSAP should ensure that all individuals involved in the testing process have appropriate contact information prior to the beginning of the testing process (i.e., WSP Team Leader and the PSAP 24x7 supervisor number).

380797 The WSP and the AHJ should mutually agree to a field-testing process that tests tower locations, sectors, and commonly available handset models in the PSAP service area.

380798 The WSP and the AHJ should independently document and record the results of testing. Subsequent to the completion of the testing, the WSP and the AHJ should meet to review and discuss testing results and agree to the methodology for any possible retests.

380799 The WSP and the AHJ should mutually agree upon notification to the PSAP prior to any network changes which may have impact on PSAP operations.

8 pseudo automatic number identification

Findings and Recommendations

There has been and continues to be a clear public expectation that the PSAP, as well as traditional first responders, will actually have consistent and accurate wireless location data delivered with all wireless 911 calls to the PSAP. This expectation exceeds the performance of many systems as deployed and evaluated as part of a designated PSAP Test Area. Public education with the goal of better managing the expectation of current service must be developed and distributed widely. Managing the expectations of first responders, as well as PSAP staff, must also be expanded and call management processes that have general applicability rather than provider specific interpretations must also be adopted.

The AHJ should implement baseline performance testing to better evaluate and understand how the system(s) serving the PSAP(s) collects and processes location data that is delivered to the PSAP.

The EPs contained herein, many of which have gained consensus by public safety through Project LOCATE and the WSPs, should be reviewed, understood, and practiced in order to maximize system service potential.

The public safety community would be best served by developing a positive partnership with the WSPs within their service area, demonstrating a solid understanding of the technology and options available, as well as maintaining open and candid communications regarding performance and service. The importance to the individual caller in crisis reaches beyond differences of opinion regarding responsibility and obligations. The supportive information contained within the attached Appendices should be reviewed and used properly to better understand wireless E911 services as well as better manage the expectations of the public and public safety/service stakeholders.

While the need for continued evolution and investment in location technology to support public safety is recognized and acknowledged, interim improvements in today's deployed systems also have benefits and are encouraged.

In conclusion:

> We understand that there are limitations to today's position determining equipment;
>
> We understand that there are business reasons for the networks deployed as they are today;
>
> We understand that the FCC accuracy parameters do not currently apply at the PSAP level;
>
> We understand that there are costs associated with any modification to existing infrastructure;
>
> We understand that performance testing of current systems at the local level has cost and time implications for local government and average consumer.

However, the challenge to provide useful location information to the PSAP for effective response to nearly half of the estimated 200 million 911 calls made annually cannot be ignored.

On behalf of every caller in crisis, it is incumbent upon all public safety and wireless community stakeholders, supported by appropriate regulatory and legislative action, to continue the collaborative effort to maximize the usefulness and consistency of wireless location data provided to the PSAP.

Acronyms

AHJ ---------- Authorities Having Jurisdiction

ALI ---------- Automatic Location Identification or Automatic Location Information

APCO ---------- Association of Public-Safety Communications Officials – Intl, Inc.

ATA ---------- American Trucking Association

ATIS ---------- Alliance for Telecommunications Industry Solutions

CAD ---------- Computer Aided Dispatch

CPE ---------- Customer Premise Equipment

COS ---------- Class of Service

DCU ---------- Data Collection Unit

DHS ---------- Department of Homeland Security

E911 ---------- Enhanced 911

ESIF ---------- Emergency Services Interconnection Forum

FCC ---------- Federal Communications Commission

GMLC ---------- Gateway Mobile Location Center

MOU ---------- Memorandum of Understanding

MPC ---------- Mobile Position Center

MSAG ---------- Master Street Address Guide

NRIC ---------- Network Reliability and Interoperability Council

OET ---------- Office of Engineering and Technology

pANI ---------- pseudo Automatic Number Identification

PCS ---------- Personal Communications Service

Project LOCATE -------- Locate Our Citizens At Times of Emergency

PSAP---------- Public Safety Answering Point

PSFA---------- Public Safety Foundation of America

SMR ---------- Specialized Mobile Radio

TCS ---------- TeleCommunication Systems, Inc.

WPH1---------- COS for Wireless Phase I

WPH2---------- COS for Wireless Phase II

WRLS ---------- COS for Phase 0, usually provides no location coordinates

WSP ---------- Wireless Service Provider

Appendices

APPENDIX A

Project LOCATE provides readers with several documents approved or in development at the time of publication which may assist in better understanding the dynamics of wireless 9-1-1 services.

These documents are the product of the Alliance for Telecommunications Industry Solutions (ATIS), which formed the ESIF, which serves as the primary venue for the telecommunications industry, public safety and other stakeholders to generate and refine both technical and operational interconnection issues. This includes those that impact the future of what public safety knows to be the life-saving E9-1-1 services that are generally available for everyone in almost all situations. ESIF allows many different telecommunications entities to fully cooperate, connect and collaborate with each other to reach a practice and/or solution that can be adopted by the majority and is related to the effective and prompt deployment of E9-1-1 services nationwide.

ESIF's mission is to facilitate the identification and resolution of both technical and operational issues related to the interconnection of telephony and emergency services networks.

APCO has participated as a member of ESIF for over five years, seeking to clarify and represent the interests of public safety in general and PSAPs in particular. There are relatively few public safety voting members and the development of work products, such as these documents, is always difficult and time consuming.

APCO Project LOCATE provides this Appendix of selected ESIF documents for use as necessary.

Documents and Topics:
Appendix A

- Confidence and Uncertainty –Document 001
- Confidence and Uncertainty Nextel Position – Document 002
- Confidence and Uncertainty Recommendation for the Use of Confidence and Uncertainty for Wireless Phase 2 – Document 003
- Mid Call Location Update (Re-Bid) – Document 004
- Maintenance Testing – Document Reference 005
- High Level Requirements for End-to-End Functional Testing – Document Reference 006
- High Level Accuracy Testing – Document Reference 007
- Wireless 9-1-1 Testing Definitions – Document 008

Appendix B

- Wireless Performance Testing by PSAP, Bexar Metro – Document 001
- Wireless Performance Testing by PSAP, Tarrant County – Document 002
- Wireless Performance Testing by PSAP, State of Texas – Document 003

Appendix C

- Wireless 9-1-1 Deployment Assistance MOU– Document 001
- Test PSAP Profiles – Document 002

APPENDIX A: 001

Confidence and Uncertainty

July 17, 2003

ESIF Recommendation for Use of Confidence and
Uncertainty for Wireless Phase 2

This is the Emergency Services Interconnection Forum (ESIF) recommendation for managing location confidence and uncertainty for Wireless Phase 2 calls. The Position Information for Emergency Services is defined in ANSI T1.628-2000, Emergency Calling Service. It defines confidence and uncertainty as follows.

"uncertainty code: Information that indicates the level of uncertainty inherent to the associated longitude/latitude information." "The uncertainty r, expressed in meters (in the range 1m to 1800km)…"

"confidence: Information identifying the confidence by which it is known that the calling party lies within the associated shape description. The confidence by which the location is known to be within the shape description, C (expressed as a percentage) is directly mapped from the binary number K, except for K=0 which is used to indicate 'no information', and $100 < K \leq 127$ which are not used."

ESIF has not made a recommendation on whether confidence and uncertainty should be delivered to the PSAP, but does have a recommendation upon the use and interpretation of confidence and uncertainty if they are delivered to the PSAP.

If confidence and certainty can be determined by the location technology then the location technology should fix confidence and vary uncertainty to illustrate the probable location of the caller.

The PSAP community is cautioned in the use of uncertainty. Because uncertainty is expressed as a circle radius and the actual algorithms to produce the location do not produce circles (e.g. some produce ellipses), there are some inherent errors in the calculation of uncertainty. Therefore, the delivery of confidence and uncertainty to the PSAP can only be used for the dispatch of responding agencies to the scene and not to verify compliance of the Position Information with the FCC mandate for accuracy

APPENDIX A: 002

Confidence and Uncertainty – Nextel Position

- Nextel cannot support the NENA recommendation to have carriers set confidence at 90% if they are going to send an uncertainty to a PSAP.
- Uncertainty validation can only be performed via a direct comparison with a known accurate ground truth point.
- Nextel's current implementation allows our system to meet the FCC requirement that R < 50 meters (67%), as tested by an independent contractor.
- Nextel meets FCC requirements regardless of the uncertainty that is sent to the PSAP.
- In Nextel's implementation the Uncertainty is represented by the EPE (Estimated Position Error), which is at a confidence set at 39.4% in a Gaussian model.
- A 2D Confidence value of 39.4 % represents a 1-sigma probability, which is a popular value used by most makers of GPS handheld units (e.g. Garmin, Magellan, Trimble).
- If a 39.4% Confidence with a 100-meter Uncertainty is changed to a 90% Confidence, the Uncertainty would become 215-meters.
- If Confidence is increased, then the Uncertainty will also increase in a Gaussian function.
- Nextel believes that increasing Confidence level at the expense of increasing Uncertainty is not worthwhile.
- Increasing Confidence level without degrading Uncertainty is not technically feasible in our AGPS implementation.
- Nextel would like to see and understand the statistical models that were used for the recommendation to increase the Confidence to 90%.
- Carriers that have made the recommendation to increase the confidence to 90 percent need to specify what (and if) Uncertainty will be provided to the PSAP.
- Contributions into the WG by carrier's representing the different technologies should be made available for Nextel's review.

APPENDIX A: 003

Confidence and Uncertainty

July 21, 2005

Emergency Services Interconnection Forum (ESIF)
Recommendation for the Use of Confidence and Uncertainty
for Wireless Phase 2

This is the Emergency Services Interconnection Forum (ESIF) recommendation for managing location confidence and uncertainty for Wireless Phase 2 calls. The Position Information for Emergency Services is defined in ANSI T1.628-2000, Emergency Calling Service. It defines confidence and uncertainty as follows.

"uncertainty code: Information that indicates the level of uncertainty inherent to the associated longitude/latitude information." "The uncertainty r, expressed in meters (in the range 1m to 1800km)…"

"confidence: Information identifying the confidence by which it is known that the calling party lies within the associated shape description. The confidence by which the location is known to be within the shape description, C (expressed as a percentage) is directly mapped from the binary number K, except for K=0 which is used to indicate 'no information', and $100 < K \leq 127$ which are not used."

ESIF has a recommendation upon the use and interpretation of confidence and uncertainty. If confidence and uncertainty can be determined by the location technology, then the location technology should fix confidence and vary uncertainty to illustrate the probable location of the caller. Issues are identified by number.

As to delivery of confidence and uncertainty to the PSAP along with location information (i.e., latitude and longitude), ESIF recommends that uncertainty be delivered to the PSAP. Confidence can be optionally delivered across the E2 interface. If the option is to not send confidence, then the E2 confidence field will be populated with zero. As confidence will never be computed at zero percent, a value of zero implies "no information" (in accordance with T1.628). As to confidence being displayed at the PSAP, ESIF recommends that confidence not be displayed at the PSAP, regardless of whether the confidence comes across the E2 interface.

Background

ESIF Subcommittee C explored the implementation of location determination with vendors developing this technology. All of the vendors use proprietary algorithms to determine the location of a wireless caller. In most cases the longer the sampling period the more accurate the location presented. All of the vendors surveyed fix confidence and let uncertainty vary as they refine the location fix. Each vendor sets the confidence at a different percentage value. The period of time to determine a satisfactory location is determined by making a statistically significant number of location fixes to meet the FCC requirements for location accuracy. Therefore, there is value to the PSAP in delivering uncertainty, but since the confidence value is fixed, it provides no additional information that would be of value to the PSAP in dispatching emergency resources.

The PSAP community is cautioned in the use of uncertainty. Because uncertainty is expressed as a circle radius and the actual algorithms to produce the location do not produce circles (e.g., some produce ellipses), there are some inherent errors in the calculation of uncertainty. Therefore, the delivery uncertainty to the PSAP can only be used for the dispatch of responding agencies to the scene and not to verify compliance of the position information with the FCC mandate for accuracy.

APPENDIX A: 004

Mid-Call Location Update aka Re-Bid
April 3, 2003

SG C Recommendation to ESIF General Session Regarding Issue 19

Re: Mid-Call Location Update, ESIF Issue 19

Mid-Call Location Update (MCLU) is the capability for a PSAP to query (rebid) for updated WPH2 Position Information of a mobile caller. Although MCLU is not required by the FCC Phase II mandate (but is implied in OET-071), there are a couple of legitimate reasons why the PSAP may have to re-query for Position Information. First, the caller's location may not have been determined by the location technology by the time the emergency call was delivered to the PSAP and the PSAP makes its initial bid for location. In this case the PSAP will receive Phase I information and may be prompted to rebid for Phase II information. If the time between the initial bid and rebid is sufficient, the location technology should have been able to locate the caller's position and it can be returned to the PSAP. Second, the PSAP call taker may determine that the caller is moving and because of the situation may have a need to obtain the current location. In this case the network will re-locate the caller and return their position to the PSAP. If a new location cannot be obtained by the network, the "last known" position may be returned.

While further experience is needed to determine the optimum interval for the re-bid, the ESIF recommendation is to wait 30 seconds after the initial bid if it is determined that a position update is required. There are a two of reasons for this. First, an additional 30 seconds should be sufficient time for the location technology to determine a Phase II compliant location fix. Second, some network elements will actually throttle PSAP requests and if they occur too frequently will return the last known address rather than requesting a new location fix.

There have been some requests that CPE vendors develop into their systems repetitive automatic re-bids. That is, without call taker intervention, the CPE would repetitively request an updated location. ESIF strongly recommends against this implementation. Not all calls require an accurate location of the caller. For example, callers reporting the same traffic accident need to be handled quickly so that the call taker can be ready for the next call. Not only is an initial location not needed, but clearly a rebid is not required. If every wireless call resulted in a rebid, the number of ALI bids would be twice that of a wireline call. And, if for an example, wireless calls rebid every thirty seconds for two minutes, the number of ALI bids would quadruple over wireline calls. This data traffic represents a real concern relating to the sizing of network elements and data networks that would have to be upgraded to accept this increased load.

Finally, early on in the discussions regarding WPH2, there were concerns expressed that location updates of a caller may lead to privacy concerns. It is ESIF's position that when a caller makes a 9-1-1 call they give up their right to privacy and the location of the caller may be delivered to the PSAP without any regards for screening.

Contribution G-37 (6/16/06)

APPENDIX A: document References 005, 006, 007

ATIS-0500010: Maintenance Testing is an ATIS standard developed by the following committee(s) under the ATIS User Interface functional group:

The Emergency Services Interconnection Forum (ESIF), Subcommittee G
Published by
The Alliance for Telecommunications Industry Solutions (ATIS)
1200 G Street, NW, Suite 500
Washington, DC 20005

For review of the entire document, visit the ATIS/ESIF website.

APPENDIX A: 006

ATIS Standard ATIS-0500009 High Level Requirements for End-to-End Functional Testing
The Emergency Services Interconnection Forum (ESIF), Subcommittee G
Published by
The Alliance for Telecommunications Industry Solutions (ATIS)
1200 G Street, NW, Suite 500
Washington, DC 20005

For review of the entire document, visit the ATIS/ESIF website.

APPENDIX A: 007

ATIS Standard ATIS-0500001 High Level Requirements for Accuracy Testing Methodologies Testing
The Emergency Services Interconnection Forum (ESIF), Subcommittee G
Published by
The Alliance for Telecommunications Industry Solutions (ATIS)
1200 G Street, NW, Suite 500
Washington, DC 20005

For review of the entire document, visit the ATIS/ESIF website.

APPENDIX A: 008

Definitions:

Accuracy Testing:
Accuracy testing, whether through empirical and/or predictive test methods, consists of generating location data to gauge the accuracy performance of the system. Location data, typically significant in volume, involves the location infrastructure of the carrier's network. The primary objective is to verify location accuracy and correct any location system errors. Limiting the test to the carrier's location network minimizes impact to the rest of the Phase II network and maximizes the capability of the carriers to optimize their system.

Event-Driven Accuracy Maintenance Trigger:
Any accuracy maintenance trigger arising from an incident within a test area or sub-area that might significantly alter the validity of pre-recorded empirical test data for the affected area.

Functionality Testing (End to End):
Functionality testing consists of testing the delivery of the location data from the carrier to the PSAP. The objective of this testing activity is to ensure interoperability between the carrier and the Emergency Service Network. This testing activity requires tight coordination among the involved parties, which normally includes the Emergency Service Network, the carrier and the technology vendors.

APPENDIX B: 001

Wireless Performance Testing by PSAP

Project LOCATE recommends that every PSAP or AHJ become aware of methods to evaluate the performance of current systems within their service area. It is important to understand the consistency and accuracy of location data delivered with wireless 9-1-1 calls at their PSAP(s). Local testing of system performance need not be elaborate or expensive. Regardless of which local testing plan used, it is important to use the same testing procedures during each testing episode in order to diminish the introduction of any new variable(s), which could modify the results. Good descriptive language about the test call site, weather, structures etc. will also be helpful as the degree of location error is calculated.
Establishing baseline performance parameters from known ground truth points within the service area, both inside and outside of buildings, from moving vehicles, rural and urban environments will provide the basis for at least two forms of action:

- Assessment of the degree of location error the system provides on calls from like points, which can be critical to making effective dispatch decisions;
- Recognition of changes in system performance, which can impact, dispatch decisions and/or may warrant a conversation with the wireless service provider about the degradation of service.

In addition, in cooperation with the WSPs, Project LOCATE has these questions that can be anticipated when reporting a degradation of system performance to a wireless service provider.

At what location are you experiencing the issue (nearest cross street or geo marker)?

When did you first notice the issue?

What experience have you had in the past from this location?

Have you made any changes to your PSAP network system?

Who should we contact for further information if needed?

Local testing plans have been provided as samples.

Wireless Performance Testing by PSAP

SAMPLE Plan Provided by Bexar Metro 911/Bexar County, TX

1.0 INTRODUCTION

The purpose of the District's Wireless Quality Assurance Program is to ensure the successful end-to-end delivery of a 9-1-1 call and locational capabilities originating from all wireless networks serving the San Antonio metropolitan area. The program provides a means for Bexar Metro to gauge the overall operational ability of each wireless 9-1-1 network on a continuing basis. This document focuses on the processes followed by Bexar Metro personnel while conducting the various forms of testing which comprise the wireless quality assurance program. Data collected will be used to validate a carrier's ability to effectively process wireless 9-1-1 traffic, identify service affecting issues, and meet the Phase II accuracy guidelines mandated in FCC 94-102.
Test elements include voice quality, network anomalies, data presentation, and Phase II accuracy. To support these requirements, the program is composed of three sections:

- Data Management
- Performance Testing
- Phase II Accuracy Testing

The process also provides an additional means of training for 9-1-1 call-takers and verifies functionality of not only wireless network elements, but also PSAP 9-1-1 call-handling and Mapped ALI customer premise equipment.

2.0 DATA MANAGEMENT

A Wireless Facility Master File is maintained by the Operations Department. This file identifies each facility by sector with coverage in the Bexar Metro area of responsibility. Information on each cell contains, but is not limited to, cell ID, sector azimuth, site address, jurisdiction, PSAP routing assignment / ESN, sector radius, ESRK range, and ALI record data. This information is updated on weekly basis as warranted by deployments and decommissions. This file is extracted on a monthly basis by GIS personnel and included as a Mapped ALI layer at all PSAPs, giving the PSAPs the ability to search by specific carrier and cell ID. Bexar Metro works diligently with all WSP to ensure the accuracy of information provided. All deployments, sector changes, and decommissions are reflected in the Wireless Facility Master File and coordinated with the respective carriers. All XY coordinates and site addresses provided by the WSPs will be mapped and cross-check for accuracy using the MSAG, GIS address interpolation tool, aerial photography, and field verification.

Staff will conduct a quarterly compare of information contained in the master file with extracts provided by the WSPs and third party database providers. Additionally, an annual routing review of all facilities located in fringe areas will be conducted to ensure annexations, boundary changes, or modifications to PSAP service areas, are adequately reflected in the master and WSP routing tables. This annual audit will be conducted first quarter of each year or as warranted by annexation activity or changes in PSAP service areas.

3.0 PERFORMANCE TESTING

Performance testing is conducted on a continuing basis in conjunction with our Phase II accuracy assessment and in situations where perceived network issues warrant additional investigation of individual cell facilities and sectors. The primary objective of performance testing is to verify the operational capability of each WSP's network through a series of test calls placed from each cell sector. Network issues adversely impacting 9-1-1 services and call quality are documented. Such conditions include blanking, busy signals, voice/transmission degradation, service outages, or the ability of the network to provide accurate Phase II location information.
The following procedures will be followed by personnel when conducting performance testing:

1. Visual inspection of cell site is conducted. Site address and FCC registration number are documented if posted. Cell site location is compared with Bexar Metro base map.

2. XY Coordinate of cell site or entrance to the location is obtained using GPS and documented in the Wireless Facility Master File.

3. A test call will be placed from each sector.

4. The following information will be documented for each sector call placed:

    - Answering PSAP
    - Callback Number presented in ALI
    - Class of Service on Call Answer and Subsequent to Rebid
    - ALI Record Format – (Carrier Code, Sector, Site Geo Reference)
    - XY Coordinates received at PSAP
    - Confidence and Uncertainty

5. Any perceived anomalies or degradations in service will be documented and proved through subsequent testing. Major service affecting issues will be reported immediately to the appropriate WSP.

4.0 PHASE II ACCURACY TESTING

The purpose of Accuracy testing is to verify the typical wireless network architecture meets or exceeds the accuracy requirements as outlined in FCC 94-102. Network-based requirements are 67% of all calls within 100 meters, 95% of calls within 300 meters. Handset requirements are 67% of the calls within 50 meters, 95% of the calls within 150 meters. Two different methodologies are used to verify Phase II accuracy provided by the wireless networks: Fixed Control Testing and Geographic Testing.

4.1 FIXED CONTROL TESTING

Fixed Control Testing is conducted using survey grade monuments to establish "ground truth" control stations. Over 200 United States Geological Survey (USGS) or Texas Department of Transportation (TXDOT) survey monuments provide the control network for this testing methodology.

The following procedures will be followed by personnel when conducting Fixed Control Testing:

Requirements:

- A minimum of one survey grade monument will be tested weekly.
- The tester must actually locate the monument and not assume its location.
- Once located, the tester will position directly on top of the monument and begin placing test calls.
- Tester safety is paramount. Extreme caution should be used in accessing control points on right of ways or high traffic areas, where terrain is questionable, and on private property. Permission to test on private property must be secured before conducting the test.

Test Procedures:

6. Technician will identify a monument to use as a control for the test prior to field deployment.
7. Technician will verify presence of monument once he arrives at location. Technician will set up directly on top of the designated monument and place all test calls from that location. The test will be aborted if a monument cannot be located and absence of monument will be noted in the monument inventory file.
8. Two test calls will be placed on each wireless carrier's network from the control station.
9. Test calls should route to the normal serving PSAP as defined in the Wireless Facility Master File.
10. Technician will verify Phase I and Phase II functionality. To this end the following information will be verified:
    - Serving PSAP
    - Callback Number presented in ALI

- Class of Service on Call Answer and Subsequent to Rebid
- ALI Record Format – (Carrier Code, Sector, Site Geo Reference)
- XY Coordinates received at PSAP
- Confidence / Uncertainty

11. The date of the test, location, and information obtained during the test will be documented and entered in the Wireless Accuracy Testing Database for further review and evaluation.

4.2 GEOGRAPHIC TESTING

Geographic Testing allows the technician to randomly create test scenarios emulating "real world" scenarios. Test calls will be placed from various points within a predefined test area. For the purpose of call tracking and analysis, a grid system comprised of 285 grids as identified in the Mapsco San Antonio Map Book is used to define the test area. A minimum of two distinct test points will be randomly selected within each grid on an annual basis, with each tested a different time period within the calendar year. The ground truth for all test points will be established using a Trimble AG-114 Differential GPS (D-GPS) receiver certified as accurate within 3.28 feet 90% of the time. The receiver is pre-set to prevent the technician from logging a control point if the Position Dilution of Precision (PDOP) exceeds 4 or fewer than 5 satellites are in view.

The following procedures will be followed by personnel when conducting Geographic Testing:

Requirements:

- On average, a minimum of 20 control points will be tested weekly.
- Each test point must be randomly selected within the confines of the established test grid.
- Tester safety is paramount. Extreme caution should be used in accessing control points on right of ways or high traffic areas, where terrain is questionable, or on private property. Permission to test on private property must be secured before conducting the test.

Test Procedures:

1. Technician will randomly select control point within designated test area.
2. Technician will establish ground truth control point using the GPS unit. A minimum of 10 points must be captured at the location and averaged before the point is logged as the official control point for the test. The point will be documented for future reference.
3. Two test calls will be placed on each wireless network from the control station.
4. Test calls should route to the normal serving PSAP as identified in the Wireless Facility Master File.
5. Technician will verify Phase I and Phase II functionality. To this end the following information will be verified:

- Answering PSAP
- Callback Number presented in ALI
- Class of Service on Call Answer and Subsequent to Rebid
- ALI Record Format – (Carrier Code, Sector, Site Geo Reference)
- XY Coordinates received at PSAP
- Confidence and Uncertainty

5.0 MID-CALL LOCATION UPDATE (MCLU) TESTING

MCLU testing allows the tester to evaluate the accuracy of the network by placing a 9-1-1 test call, advancing his position, and requesting the 9-1-1 call-taker conduct a rebid of the coordinates for the call. This type of testing can be conducted two ways 1) driving in a moving vehicle and requesting frequent rebids or 2) traveling to multiple fixed location sites and conducting the rebid. MCLU testing will be done at the beginning of each month.

6.0 DOCUMENTATION AND ANALYSIS OF TEST DATA

Data collected will be entered into the Wireless Quality Assurance Testing Database and Accuracy Summary Tables on a weekly basis. The Wireless Quality Assurance Testing Database is used to track all activities associated with wireless quality assurance testing.

Documentation for each test will include:

- Type of Test – Monument, Grid, Performance, MCLU
- Date of Test
- Network
- Test location area
- Provisioned or Non-provisioned test set
- Accuracy Results (if applicable). The delta between the control point's coordinates and those reported by the PSAP will be calculated and entered into the appropriate field.
- Description of any degradations or anomalies in service (Incorrect ALI, Blanking, Misrouted call, Phase II issues)
- Test Results – Pass or Fail

The Accuracy Summary Tables provide an assessment on the Phase II accuracy results obtained for each WSP's network during Fixed Control and Geographic Testing. The results are expressed as a percentage and can be viewed on a monthly, yearly, or total project perspective.

7.0 TROUBLE REPORTING

All anomalies or service degradations will be documented and reported to the Director of Operations or Deputy Director of Operations on a daily basis. Service issues impacting wireless call delivery, such as network failures, degradations in Phase II accuracy, Phase 0 translations, or call routing issues will be reported immediately to the appropriate WSP network operations center, third party database provider, or local WSP engineering group.

The following information must be documented for each case of trouble encountered:

- Wireless Network
- Cell Site Number / Sector
- Time of Call
- Date of Call
- Phone number of test instrument
- ESRK
- Description of trouble encountered

Technician should refer to the District's Operations Escalation list for the appropriate wireless or network points of contact for reporting purposes.

Bexar Metro 9-1-1 Network District
WIRELESS QUALITY ASSURANCE
Testing Methods and Procedures Document
Revised November 2006

APPENDIX B: 002

Wireless Performance Testing by PSAP

SAMPLE Testing Plan submitted by Tarrant County, Texas for evaluating the performance of, as well as accuracy of data delivered to their PSAP(s) as a sample as well. Phase 2 Call Testing

Objective of Phase 2 Call Testing

The objective of this round of Phase 2 testing is to determine if the wireless carrier is meeting the FCC mandate for accuracy.

WSP X, WSP Y and WSP Z are using the network solution – 67% within 100 meters and 90% within 300 meters.

WSP A, WSP B and WSP C are using the handset solution – 67 % within 50 meters and 90% within 150 meters.

We will issue a report card for each of the 6 major carrier in each of the 2 categories stating the actual % of calls in each of the 2 mandates.

For example:

WSP X delivered 72% of calls tested within 100 meters.
WSP X delivered 93% of calls tested within 300 meters.

In addition, a map detailing results (color coded) for each of the carrier's test sites will be provided.

Methods and Procedures for Phase 2 Call Testing

Geographically diverse test sites

The base map of the territory covered by Tarrant County 9-1-1 District consists of 159 MAPSCO grids. There will be at least 2 test sites per MAPSCO grid. This will provide a base of at least 318 geographically diverse test sites.

Number of test calls per carrier

We will make 2 calls from each carrier's phone at each of the 318 test sites. This will provide a base of at least 636 test calls per carrier.

Since WSP Y and WSP Z have 2 networks (TDMA and GSM), we will provide a base of at least 636 test calls for each carrier's TDMA network and at least 636 test calls for each carrier's GSM network.

Location of caller at each test site

The call tester will be standing at the corner of an intersection.

A later round of call testing will be conducted from various "environments" such as inside a building, inside a car and in an urban canyon. These results will be compared to the base line results established by this round of testing.

Measuring the deviation distance

The measurement tool in the mapped ALI display at the PSAP is used to determine the accuracy of the location.

Since the caller will always be located at an intersection, one point of measurement will be the intersection.

The other point of measurement will be icon on the map.

The measurement tool displays the number meters to 2 decimal places.

All measurements will be rounded to the nearest whole meter.

Time between initial call delivery and 1st re-bid

The tester in the PSAP will wait at least 15 seconds before a re-bid is launched.

Number of re-bids per test call

Every test call will consist of the initial call delivery to the PSAP and one re-bid.

If the distance deviation is over (fail) the FCC mandate after one re-bid a second re-bid will be made and the data recorded.

If the second re-bid "passes" the call, it will be recorded as a pass.

Determining Pass/Fail for each call

Every location will be given a +/- 10 meter halo to account for the fact that the call tester is standing at the corner instead of the middle of the intersection.

Locations that are within the +/- 10 meter halo are considered "conditional" data points.

Locations that are not within the +/- 10 meter halo are considered "absolute" data points.

There are 4 possible "grades" for each call:

- AP = Absolute Pass
- CP = Conditional Pass
- CF = Conditional Fail
- AF = Absolute Fail

For the 50 meter goal:

- 0 – 40 m = AP
- 41 – 50 m = CP
- 51 – 60 m = CF
- 61 + m = AF

For the 100 meter goal:

- 0 – 90 m = AP
- 91 – 100 m = CP
- 101 – 110 m = CF
- 111 + m = AF

For the 50 meter goal:

- 0 – 140 m = AP
- 141 – 150 m = CP
- 151 – 160 m = CF
- 161 + m = AF

For the 50 meter goal:

- 0 – 290 m = AP
- 291 – 300 m = CP
- 301 – 310 m = CF
- 311 + m = AF

Absolute data points only will be used to determine the overall grade of the carrier in meeting the FCC mandates for location accuracy.

January, 2007 Courtesy of Tarrant County 9-1-1

APPENDIX B: 003

Wireless Testing by PSAP and WSP

Project LOCATE provides a sample testing plan and agreement between a AHJ and the WSPs for testing. The primary purpose of such plans, although they need not be elaborate, is to discuss and mutually agree on the expectations of each other as well as the method by which review will be possible.

CSEC Wireless Phase I & II E9-1-1

PSAP Testing Procedures
And
Notification and Certification of Service

Purpose

The purpose of this document is to provide guidance to 9-1-1 Entities, WSP and third party vendors in the provisioning of Wireless E9-1-1 Phase I & Phase II service throughout the State of Texas by establishing notification policies, testing procedures, and certification documentation requirements.

In preparation for wireless deployment, the Commission on State Emergency Communications (CSEC) has designed procedures and spreadsheets for use by you and your PSAPs for wireless testing. As all 9-1-1 professionals are aware, testing and certification are critically important in all new service deployments. These procedures may be tailored to better suit the needs of the individual regions. We appreciate your assistance in insuring that wireless Phase I & II E9-1-1 service is deployed accurately and efficiently.

Scheduling and Notification

The following information will be utilized in defining new deployment and maintenance when determining testing and documentation requirements of Wireless E9-1-1 Phase I & Phase II service.

New Deployment: Initial deployment of wireless cell sites that occurs when a wireless service provider has not previously deployed in a PSAP jurisdiction within the 9-1-1 Entity's region. For example, if a carrier has deployed in one PSAP within a county – like the Sheriff's Office – but not the others, and later adds towers within one of the cities. This would be a new deployment because the carrier was not previously deployed within that city.

Maintenance: Maintenance occurs when a wireless service provider has already deployed E9-1-1 cell sites within a PSAP jurisdiction, and then adds a new cell site (or sites) or temporary cell site within that PSAP jurisdiction. For example, the carrier is already deployed and certified in a county, but they increase the number of towers in that county. This would be considered maintenance because the carrier is already providing Phase I service in that area.

Testing Notification Procedures:

Wireless testing should be scheduled through the COG on behalf of each PSAP, by each of the WSP in your region. All scheduling is subject to the specific needs of each region and each wireless carrier. Testing schedules and arrangements should be mutually agreed upon in advance so that the proper notifications and preparation of all affected parties can be made. Advance paperwork must include a Testing Validation Worksheet (TVW). If no TVW is made available at time of scheduling, a TVW must be received from the WSP five working days in advance of approved – scheduled test date.

We request that you notify CSEC of any testing that is scheduled so that we can keep current on wireless deployment activities across the state, and facilitate in any way necessary.

Due to the nature of wireless networks and testing, it may not always be possible for a COG to have personnel at each PSAP, for each test call, for all carriers. The COG will probably need to rely upon calltakers or other PSAP personnel to assist with verification of call routing and data delivered by the wireless carrier. This is completely acceptable as long as the basic testing procedures are followed by the COG/PSAP, and the criteria are met by the wireless carriers. These procedures and related spreadsheets have been designed with this in mind.

Wireless Testing

There are two phases of new deployment wireless testing: profile testing and field-testing. These are separate tests and will usually occur at separately scheduled times.

Profile Testing - is preliminary testing that occurs prior to any field-testing, and is designed to test the different call scenarios and variables that may occur with wireless calls. No documentation is needed for profile testing. This type of testing confirms that the wireless carriers' mobile switching center (MSC) is routing correctly through the designated 9-1-1 tandem. This level of testing also allows the PSAP to verify that there are no CPE or screen format problems related to wireless calls.

Field Testing – verifies that calls made from each cell site and cell sector are routed correctly to the designated PSAP, that the callback number is delivered and displayed correctly on the CPE, that the correct and accurate cell site/sector data is provided along with the call, and for Phase II the X, Y coordinates of the caller are delivered.
Spreadsheet models for each type of testing are provided.

- The top portion of each spreadsheet should be completed by the COG and will provide basic information about the test.
- The Site ID and Site Address fields should be completed by the wireless carrier since this will provide identical information to both the wireless carrier personnel and the PSAP against which to verify location, routing and data delivery.
    - CSEC recommends that the COG request this information from the carrier upon receiving a notification to test.
    - CSEC recommends that the COG provide these spreadsheets to the carrier electronically so that the carrier can populate these fields well in advance of the testing dates, providing the COG adequate time to distribute this information to the affected PSAPs.

- It is also completely acceptable for COGs & PSAPs to use validation worksheets provided by the wireless carriers as long as the format used contains the required information. Many carriers have these spreadsheets readily available and this alternative is simpler and faster in many instances.

Field Testing

For each cell site and sector, the carrier will need to test and verify the following: routing, call back number, and location information. This will be accomplished through dialogue between the wireless carrier field personnel and the PSAP personnel, reading off and confirming data and information to each other. ***The success or failure for each cell site and sector should be recorded on the attached spreadsheet.*** The following scenarios and information must be tested:

- Site Address – address of the cell site location
- Sector Orientation and Number – cell sector directional information and number, i.e. 1, 2, 3, or "ALL" if an omni tower
- Correct Screen Format – verify that call back number and location information display in the correct CPE screen format field
- Designated PSAP - populated by the wireless carrier, and previously designated by the COG, as the PSAP to which calls originating from that particular cell site/sector should be delivered
- PSAP Routed to During Test – verification by the PSAP that the call was routed to the appropriate designated PSAP
- Call Back Number (CBN) – verification that the call back number was delivered and displayed appropriate to the CPE screen format, and that the correct call back number was delivered.
- For Phase II verify that the class of service came in "WRLS" not "MOBL", and then after the rebid it changed to "WPH2". CSEC is not certifying the accuracy of Phase II calls; accuracy is being certified by the carriers prior to the deployment.

Maintenance Site Testing

The WSP should notify the 9-1-1 entity in advance of the actual maintenance 9-1-1 testing. Documentation will be provided to the 9-1-1 Entity with proposed routing and addressing information. The data will be provisioned as shown on the documentation. The 9-1-1 Entity will revise the received TVW if required. The data will be updated as specified by the 9-1-1 Entity on the revised TVW. If the 9-1-1 Entity does not respond with revisions to the TVW within 10 working days, no changes will be made to the data as originally provisioned and as shown on the original TVW (or equivalent). The WSP should verify via e-mail within three business days (of its submission of TVW) that the 9-1-1 Entity has received the TVW. The email should include a reminder of the 10-day deadline. When the 9-1-1 Entity responds with revisions, it should clearly communicate the acceptance of all other data on the TVW. If the 9-1-1 Entity does not respond with revisions to the TVW, the WSP can turn up Phase I service and notify the RPC as soon as possible after the turn-up.

Notice of Certification and Deployment

CSEC requires that the COG notify us, formally and in writing, upon the successful testing and deployment of new wireless service for each wireless carrier that provides wireless Phase I or Phase II E9-1-1 service in the region. CSEC does not require documentation for maintenance testing. Based upon recommendation of the State Auditor's report, CSEC requires that PSAP validated TVWs be submitted in conjunction with this notification. If a PSAP validated TVW is not available, the screen prints for each sector of each tower must also be sent to CSEC.
CSEC suggests that the COG also provide a copy of this notification to the wireless carrier as certification of acceptance of the testing and subsequent service. Attached you will find a "Certification Letter" that has been developed for use by the CAPCO region for these purposes. CSEC recommends this format as a "Best Practice" model for other regional councils to adapt and utilize for the same purposes. Should there be any cell sites/sectors that failed the testing criteria, retesting will be required until they are successful in meeting the requirements. Notification and certification should include the following information at a minimum:

- Acceptance and documentation of successful Field Testing for each cell site and sector, and delivery of call back number (See attached CSEC Wireless Deployment Documentation Acceptance Criteria)
- Itemization of each county in which wireless Phase I E9-1-1 service was deployed
- The population of each county in which this service was deployed
- A list of each PSAP successfully receiving wireless 9-1-1 calls

CSEC appreciates your assistance with this important matter. If you should have questions or comments regarding wireless testing, or these procedures, please contact the following:

See Also Documentation Criteria – Next Page

Wireless Deployment Documentation - Acceptance Criteria

_____ _____
RPC Wireless Carrier

_____ _____
County PSAP

Wireless Documentation must meet the following requirements in order to be certified to the CSEC and the carrier as tested and deployed. BOTH notification & certification AND field-testing documentation MUST be submitted to be accepted.

_____ **Notification & Certification Letter from the COG, should include the following information:**

_____ Carrier Name

_____ Number of Cell Sites Tested

_____ Number of Cell Sectors Tested (not required)

_____ Total number of cell site sectors routed correctly

_____ Total number of cell site sectors unsuccessfully routed

_____ Overall Percent Successful

_____ List of unsuccessful routing, and request for retest

_____ County Name

_____ County Population (according to Texas State Data Center)

_____ PSAP Name

_____ Date of Implementation

_____ **Field Testing Documentation should consist of:**

_____ PSAP Validated Field Testing Worksheet
These should clearly demonstrate that the PSAP personnel physically received calls from the wireless carrier to validate each cell site and sector listed on the spreadsheet.

-OR-

_____ Carrier-provided Field Testing Worksheets

AND

_____ **PSAP Screen Print Outs to Validate**
This data should clearly substantiate carrier results.

APPENDIX C: 001

Wireless 9-1-1 Deployment Assistance

Project LOCATE, as part of a separate wireless deployment information and training program, has developed the "Deployment Handbook."[1] This self-assessment tool allows any AHJ or specific PSAP to evaluate current needs and readiness for effectively participating as an informed partner with any WSP in maximizing deployment within the service area.

In addition, a sample Memorandum of Understanding (MOU) enumerating the responsibilities of the public safety entity as well as the Wireless Service Provider and others is provided.

1 Deployment Toolkit Summary Handbook: http://www.locatemodelcities.org/documents/Handbook0806.pdf

ENHANCED 9-1-1
MEMORANDUM OF UNDERSTANDING

Between _____and_____

WIRELESS CARRIER RESPONSIBILITIES

It shall be WSP's responsibility, in cooperation with 9-1-1 Governmental Entity and necessary third parties (including, but not limited to, Vendor, 9-1-1 Network Provider, Host ALI Provider, SCP software developers and hardware providers, and other suppliers and manufacturers), to implement and provide Phase __ E9-1-1 Service to 9-1-1 Governmental Entity in the agreed upon manner within the Phase __ E9-1-1 Service Areas. This shall include the following:

- Participating in network design:
- Causing its network elements (such as the MSC and related data links and trunks) to be installed;
- Operating, maintaining and provisioning these network elements;
- Facilitating or participating in the development of an implementation plan which will establish target dates for actions necessary for installation and activation of E9-1-1 Service;
- Acquiring necessary software and equipment;
- Entering into necessary interconnection agreements for interconnecting the MSC to Selective Routers and, if necessary, for interconnecting the SCP;
- Coordinating or participating in the adds, changes and deletions of database records in appropriate databases, including, but not limited to ALI Host database and Selective Router;
- Providing initial Cell Site/Sector Information and updates as they occur.

9-1-1 GOVERNMENTAL ENTITY RESPONSIBILITIES

It shall be 9-1-1 Governmental Entity's responsibility to work with WSP and, where necessary, with third parties (including, but not limited to, Vendor, 9-1-1 Provider/LEC, Host ALI Provider, SCP software developers and hardware providers, and other suppliers and manufacturers) for the successful implementation and provision of Phase __ E9-1-1 Service. This shall include the following:

a) validating 9-1-1 Governmental Entity Jurisdiction map boundaries

b) participating in the development of an implementation plan which will establish target dates for actions necessary for installation and Activation of E9-1-1 Service

c) providing and verifying needed data about each PSAP's existing infrastructure and any other information necessary for successful installation, maintenance and provision of E9-1-1 Service

d) informing third-party vendors, such as Computer Aided Dispatch (CAD) providers, of data to be delivered with 9-1-1 calls for coordination with PSAP premise-based systems

e) augmenting the trunks, when necessary, as agreed upon by Parties, between a selective router and any PSAP

f) ensure that all PSAP premises equipment is equipped to receive E9-1-1 voice and data services

g) informing WSP of any 9-1-1 Governmental Entity system changes that may affect E9-1-1 Service

h) provide that necessary changes, modifications and/or updates are made with respect to the ALI Database for successful receipt of ALI Host Records

i) supporting all testing/verification activities to be undertaken by WSP, or Vendor or third party, if applicable, in relation to this MOU

j) participating in the creation of a trouble reporting mechanism and associated trouble resolution process

k) cooperate in testing, troubleshooting, modifications and other activities necessary to the implementation and continued operation of the E9-1-1 Service

Target Deployment Date:_____

WIRELESS CARRIER CONTACTS:

E9-1-1 Service Deployment Contact Name & Number:_____

E9-1-1 Service Deployment Vendor (If appl.):_____

Wireless Carrier Testing Contact Name & Number:_____

Wireless Carrier 24 x 7 Security Number:_____

Post-Deployment Trouble Reporting:_____

9-1-1 GOVERMENTAL ENTITY CONTACTS:

E9-1-1 Service Deployment Contact Name & Number:_____

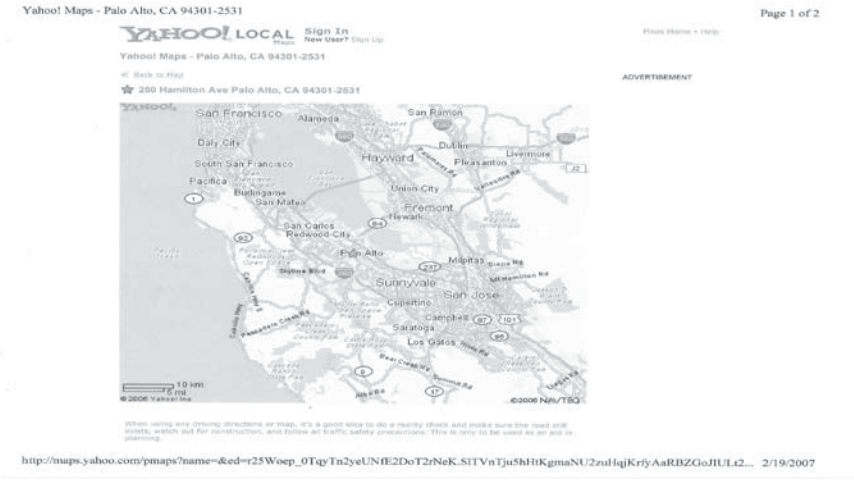
Deployment Testing Contact Name & Number:_____

Government Auth. 24 x 7 Contact Name & Number:_____

APPENDIX C: 002

PSAP Test Areas
Wireless Accuracy Test Area Summary

Palo Alto, CA



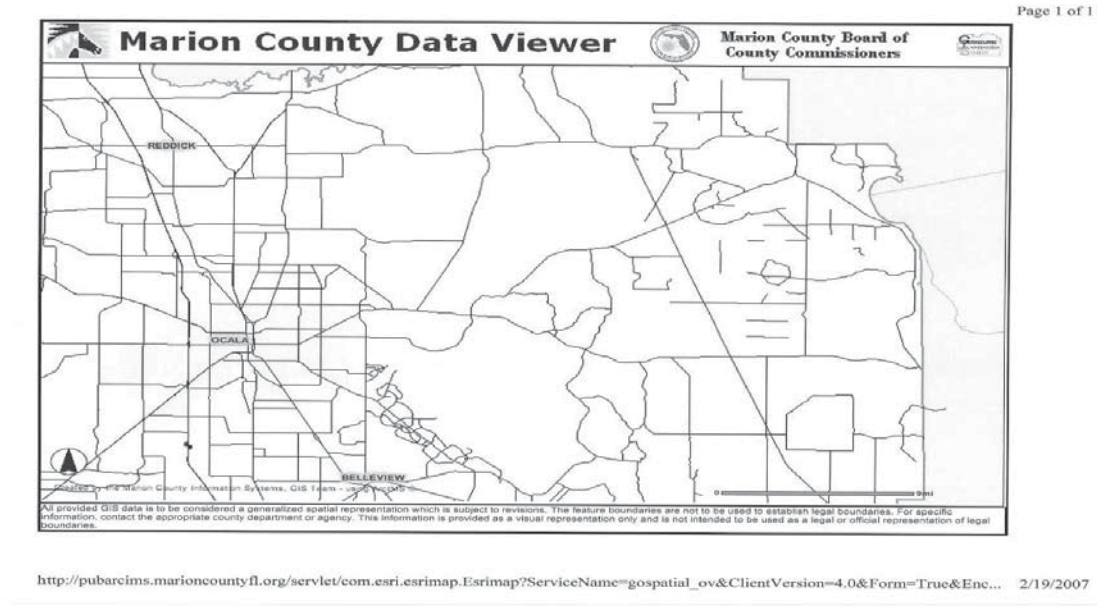
PSAP Test Area Summary
Located 35 miles south of San Francisco and 14 miles north of San Jose, Palo Alto is a community of approximately 61,200 residents. Part of the San Francisco Metropolitan Bay Area and the Silicon Valley, Palo Alto is located within Santa Clara County and borders San Mateo County. The City's boundaries extend from San Francisco Bay on the east to the Skyline Ridge of the coastal mountains on the west. The City encompasses an area of approximately 26 square miles and is strategically located and easily accessible to major surface routes, including Interstate 280, Highway 101, Highway 84 - the Dumbarton Bridge and Highway 92 - the Hayward-San Mateo Bridge

Name of Agency: Palo Alto Police Department
275 Forest Ave, Palo Alto, CA 94301
LOCATE Contact Person: Charles Cullen
Service Population: 150,000
911 System Service Provider: SBC
Customer Premise Equipment:

1. **Telephony: Motorola Centralink**
2. **Computer Aided Dispatch: PSSI**
3. **Mapping Utilization Solution: City GIS Application**

Average annual 9-1-1 Calls and percent of which are wireless:
25,000 50% wireless
Wireless Phase II deployed by: Nextel, Verizon, Cingular, Sprint, T-Mobile and Metro PCS
PSAP Data a used in Test Area Selection Process, Fall, 2005

Ocala/Marion County, Florida



PSAP Test Area Summary

Ocala/Marion County in Florida boasts a unique mixture of rural and urban lifestyles within its boundaries. Our rolling hills and majestic tree-lined scenic country roads are a surprise to many first time visitors. Centrally located in the very Heart of Florida, there is easy access and almost equal distance to the Gulf of Mexico and the Atlantic Ocean. The county is divided by Interstate Highway 75 N/S and State Road 40 E/W, both serving as daily transit routes as well as emergency evacuation routes.

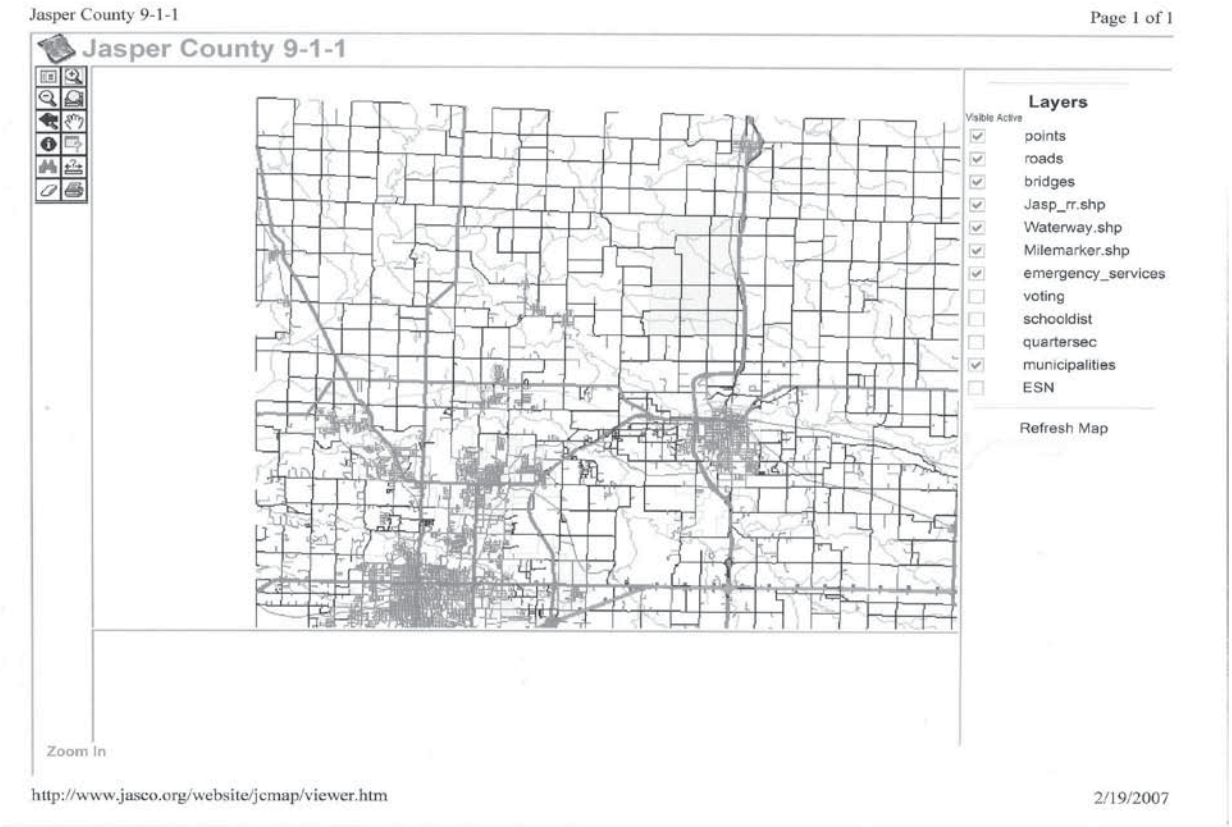
Name of Agency: Marion County 9-1-1 Communications
Two PSAPS: Marion County Sheriff's Department
City of Ocala Police Department
LOCATE Contact Person: Dick Nelson, Director
Service Population: Est. 600,000 – 750,000
911 System Service Provider: Sprint
Customer Premise Equipment:

1. **Telephony: Plant Equipment**
2. **Computer Aided Dispatch: Per Agency**
3. **Mapping Utilization Solution: Mapped ALI, MARS-VESTA w/Orion MapStar**

Average annual 9-1-1 Calls and percent of which are wireless:
200,000 47% wireless
Wireless Phase II deployed by: Cingular, Alltel, Sprint, Verizon,
Nextel, T-Mobile

PSAP Data as used in Test Area Selection Process, Fall, 2005

Jasper County, MO



PSAP Test Area Summary

Jasper County, Missouri is located in Southwest Missouri, shares a common border with Kansas, Oklahoma is minutes away and Arkansas is less than an hour. The County is crossed by Interstate Highways 44 (E/W and 71 N/S). The resident population reported as 110,624 in 2005, is diversely settled over the 640 square miles within the county borders.

Name of Agency: Jasper County Emergency Services Board
13870 Dispatch Ln. Carthage, MO 64836
LOCATE Contact Person: Ronald Boyer, Executive Director
Service Population: 350,000
911 System Service Provider: SBC
Customer Premise Equipment:

1. **Telephony: Nortel Meridian**
2. **Computer Aided Dispatch: Intergraph**
3. **Mapping Utilization Solution: ESRI, Intergraph**

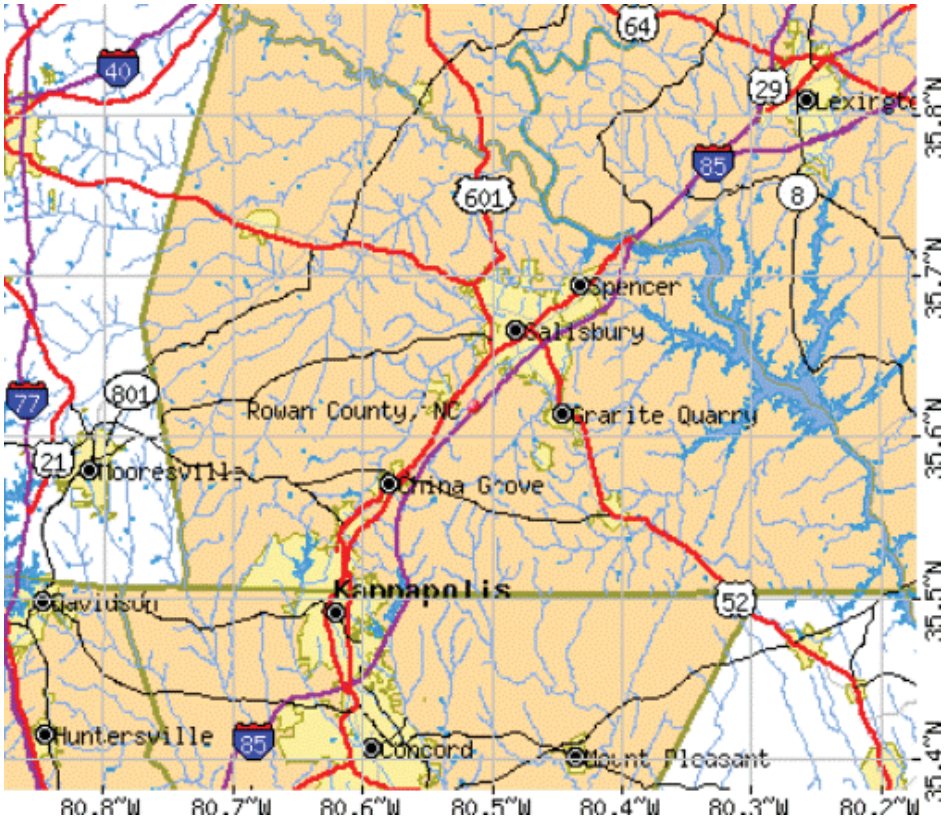
Average annual 9-1-1 Calls and percent of which are wireless:
32,000 70% Wireless
Wireless Phase II deployed by: AT&T, Cingular, Sprint, T-Mobile
US Cellular (in progress)

PSAP Data as used in Test Area Selection Process, Fall, 2005
Syracuse, NY

PSAP Test Area Summary
The County of Onondaga is located in the central New York region, has a land area of 793.5 square miles and is approximately 35 miles in length and 30 miles in width. The resident population is nearly 500,000. Onondaga County is the home to Syracuse University, home of the Carrier Dome and LeMoyne College. The County serves as the crossroads of New York State, bisected by the New York State Thruway and US Route 81. The topology of the county is flat in the northern half of the county and hilly in the southern half of the county.

Name of Agency: Onondaga County 9-1-1 Communications Control Center
3911 Central Ave., Syracuse, NY 13215
LOCATE Contact Person: Stephen J. Wisely, Commissioner
Service Population: 750,000
911 System Service Provider: Verizon
Customer Premise Equipment:
1. Telephony: Plant Vesta
2. Computer Aided Dispatch: PRC
3. Mapping Utilization Solution: Mapped ALI – Orion MapStar
Average annual 9-1-1 Calls and percent of which are wireless:
650,000 50% wireless
Wireless Phase II deployed by: AT&T/Cingular, T-Mobile, Nextel Partners,
Sprint, Verizon Wireless, Cricket
PSAP Data as used in Test Area Selection Process, Fall, 2005

Rowan County, NC



PSAP Test Area Summary

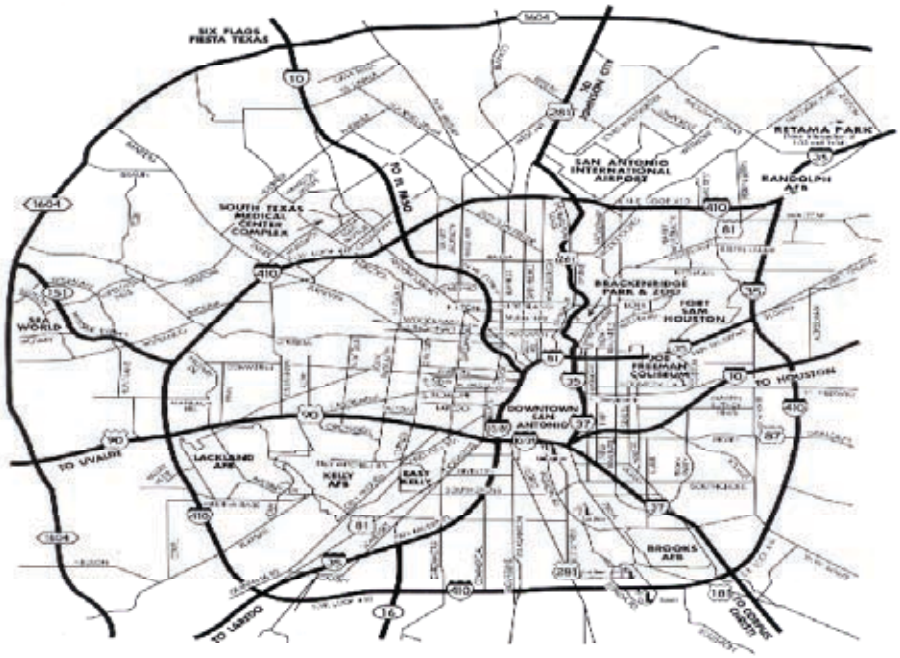
Rowan County is one of 100 counties in North Carolina. The county is in the Salisbury metro area and had an estimated population in 2004 of 134,317 living within a total area of 524 square miles.

Name of Agency: Rowan County 9-1-1
232 N. Main St. Suite 202
Salisbury, NC 28144
LOCATE Contact Person: Frank Thomason and Rob Robinson
Service Population: 140,000
911 System Service Provider: BellSouth
Customer Premise Equipment: Positron

1. **Telephony:**
2. **Computer Aided Dispatch**
3. **Mapping Utilization Solution Mapped ALI**

Average annual 9-1-1 Calls and % wireless:
130,000 dispatched calls / 35% wireless
Wireless Phase II deployed by: Verizon, Sprint, Nextel, AT&T/Cingular, Sun Telecom, Alltel, Cricket
PSAP Data as used in Test Area Selection Process, Fall, 2005

Bexar County, TX



PSAP Test Area Summary

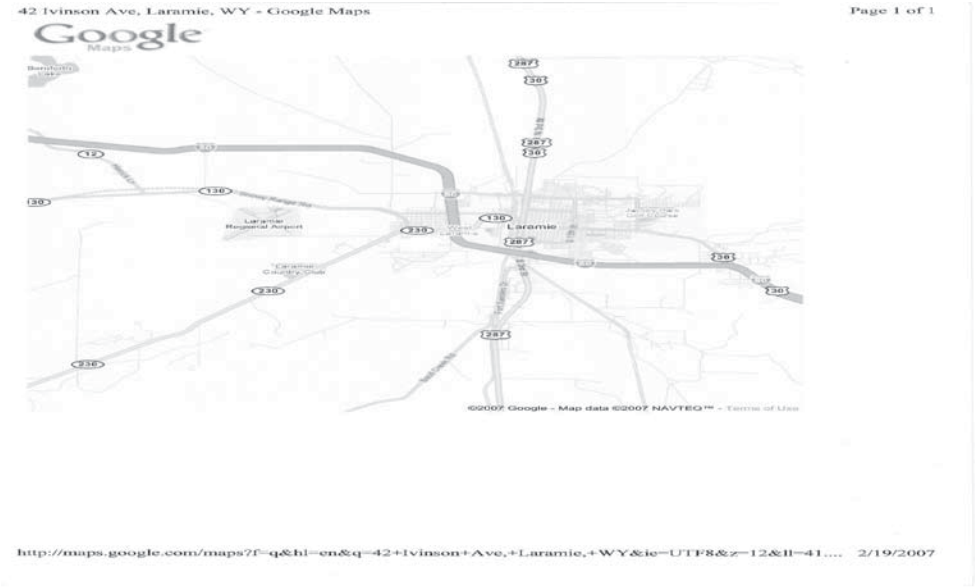
Bexar County is located in South Central Texas. The county seat of Bexar County, and its largest city, is San Antonio. Bexar County takes up an area of 1,248 square miles. The estimated population in 2004 was 1,493,965.

Name of Agency: Bexar Metro 9-1-1 Network District - Bexar County Sheriff
Bexar County was Primary Test Area
203 W Nueva, RM 309, SAN ANTONIO, TX 78204
LOCATE Contact Person: Brett Schneider
Service Population: 1.4 Million in entire 9-1-1 District
911 System Service Provider: SBC
Customer Premise Equipment

1. **Telephony: Positron Power911**
2. **Computer Aided Dispatch: Hybrid System - Agency**
3. **Mapping Utilization Solution: Positron PowerMap**

Average annual 9-1-1 Calls and percent of which are wireless:
Bexar County Sheriff – 56,308 55%
Wireless Phase II deployed by: Cingular (Orange and Blue Networks)
Sprint, Nextel, T-Mobile, Verizon
PSAP Data as used in Test Area Selection Process, Fall, 2005

Laramie, WY



PSAP Test Area Summary

Laramie is the county seat of Albany County. At 7165 feet, Laramie is nestled in the Southeast corner of the still "unsettled" State of Wyoming. The city is near the intersections of I-80 and I-25 and houses the University of Wyoming. The Laramie Mountains span along the eastern county line.

Name of Agency: Laramie Police Department
42 Ivinson Ave., Laramie, WY. 82070
LOCATE Contact Person: Cmdr: Dale A. Stalder
Service Population: 32,000 exclusive of tourists and interstate travelers
911 System Service Provider: Qwest
Customer Premise Equipment:

1. **Telephony: Motorola CentraLink**
2. **Computer Aided Dispatch: Sungard H.T.E.**
3. **Mapping Utilization Solution: Positron PowerMap**

Average annual 9-1-1 Calls and percent of which are wireless:
12,000 ave. 55% wireless
Wireless Phase II deployed by: Verizon, Alltel, Sprint PCS

4. **Mapping Utilization Solution: Positron PowerMap**

Average annual 9-1-1 Calls and percent of which are wireless: 12,000, running between 48 and 64% monthly from wireless
Wireless Phase II deployed by: Cingular/AT&T, AllTel, Nextel, Sprint PCS, Verizon, Cricket
PSAP Data as used in Test Area Selection Process, Fall, 2005

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Willis Carter, President Elect
Chris Fischer, First Vice President
Richard Mirgon, Second Vice President

The APCO International Executive Council

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Martin Moody, Executive Director, Metropolitan Emergency Services Board, Minnesota
Greg Ballentine, MARC, Kansas City, Missouri, Past President APCO International
Chris Fischer, Valley Communications, Kent, Washington, APCO First Vice President, Board Liaison
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Dale Stalder, Laramie, Wyoming
Dick Nelson, Marion County, Ocala, Florida
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For more information on Project LOCATE visit: www.locatemodelcities.org

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