

RECOMMENDED BEST  
PRACTICES FOR

# SUPPLEMENTAL 9-1-1 LOCATION DATA





## SECTION 1: INTRODUCTION

This document was developed by the National Emergency Number Association (NENA),<sup>1</sup> the National Association of State 911 Administrators (NASNA),<sup>2</sup> and the Industry Council for Emergency Response Technologies (iCERT),<sup>3</sup> in cooperation with the National 9-1-1 Program.<sup>4</sup> It is designed to establish guidance on the potential use by the nation's Public Safety Answering Points (PSAPs) of 9-1-1 location data provided outside of the traditional process used by wireless carriers. The potential use of such "supplemental 9-1-1 location data" in addition to data provided by the carriers may assist in locating 9-1-1 callers quickly and accurately. This document describes recommended best practices for how such data should be provided to and used by PSAPs.

## SECTION 2: BACKGROUND

The nation's 9-1-1 emergency communications services and systems are critical to promoting public safety and for enabling first responders to effectively respond to requests for emergency assistance. Originally developed to enable voice calls from traditional landline telephone networks, 9-1-1 services and systems continue to evolve to accommodate the ever-changing communications preferences and safety needs of the American public. Today, more than 70% of all 9-1-1 calls originate on wireless networks. While wireless access provides 9-1-1 authorities with a greater ability to aid those in need, the challenges associated with locating a wireless caller are not trivial, especially for calls made from indoor locations.

A 9-1-1 caller's location is generally considered to be the most critical piece of information required to dispatch emergency responders in a timely fashion, and various technological solutions have been developed over the years to aid wireless carriers in meeting this critical need. Initially, location solutions focused on 9-1-1 calls made from outdoor locations and utilized the carriers' own wireless networks as well as satellite networks available to the public (i.e., GPS) to locate callers. As wireless 9-1-1 calling has increased, attention has shifted to developing solutions that also allow carriers to locate callers indoors. Many of these solutions are designed to leverage the increasing proliferation of Wi-Fi networks deployed across the country, while also enhancing traditional location methods (e.g., improved satellite-based location systems).

One example of a new location technology being developed by device manufacturers and deployed by wireless carriers is Device-Based Hybrid (DBH); a technology that uses a mix of location methods available to the calling device including crowd-sourced Wi-Fi, Assisted Global

<sup>1</sup>NENA: The 9-1-1 Association serves the public safety community as the only professional organization solely focused on 9-1-1 policy, technology, operations, and education issues; see [www.nena.org](http://www.nena.org).

<sup>2</sup>NASNA is comprised of State 9-1-1 program administrators and is the voice of states on public policy issues impacting 9-1-1; see [www.nasna.org](http://www.nasna.org).

<sup>3</sup>iCERT is the trade association representing the emergency response sector; see [www.theindustrycouncil.org](http://www.theindustrycouncil.org).

<sup>4</sup>The National 9-1-1 Program's mission is to provide federal leadership and coordination in supporting and promoting optimal 9-1-1 services. This Federal "home" for 9-1-1 plays a critical role by coordinating efforts that support 9-1-1 services across the nation. See <https://www.911.gov> for more information.



Navigation Satellite System (A-GNSS),<sup>5</sup> and handset-based sensors. Two important examples of DBH location technology are Hybridized Emergency Location (HELO) developed by Apple for its iOS and watchOS devices and Emergency Location Service (ELS) developed by Google for its Android operating system. Implementation of these technologies by some wireless carriers has already begun; more carriers are expected to utilize DBH in the future.

More recently, DBH-based solutions are being used by location service providers to provide PSAPs with 9-1-1 location information without the direct involvement of a wireless carrier, i.e., location data that is “supplemental” to the data that the wireless carrier already provides. The availability of supplemental data, if provided and used effectively, may provide PSAPs and first responders with additional information that allows them to determine the caller’s location more quickly and accurately and potentially save lives. The degree to which this supplemental data meets their needs, however, will depend on how the location is determined, how the information is conveyed to the PSAP, and how the Telecommunicator uses the information as part of any emergency response effort.

This document describes how supplemental 9-1-1 location data is provided to PSAPs, compares and contrasts those processes to the way location information is provided in conjunction with traditional 9-1-1 call processes, and recommends a set of best practices that are designed to guide the development, delivery, and use of such data.

## SECTION 3: USING SUPPLEMENTAL LOCATION DATA TO ENHANCE 9-1-1 SERVICES

### A. DESCRIPTION OF SUPPLEMENTAL 9-1-1 LOCATION DATA

Supplemental 9-1-1 location data can be defined as “*any location data associated with a 9-1-1 call that is provided to a PSAP without the involvement of the originating carrier.*” As already noted, supplemental 9-1-1 location data is typically determined today using DBH-based technologies. In the future, however, such data may be determined using other technologies, and the best practices included within this document are designed to be technology-agnostic and equally applicable to any 9-1-1 location data provided outside of the process employed by wireless carriers, regardless of technology.

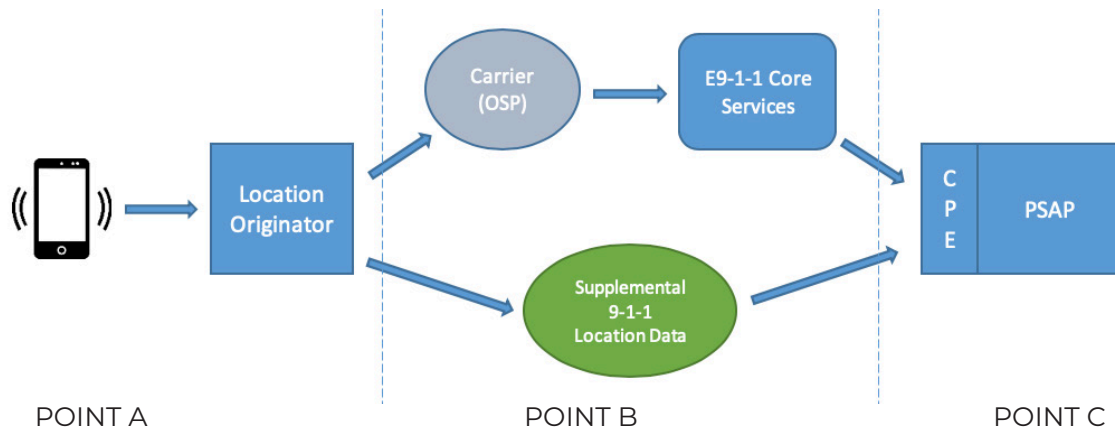
To understand how supplemental 9-1-1 location data might be used most effectively by PSAPs, it’s important to understand the processes typically used for providing such data and how those processes compare to traditional 9-1-1 call processes used by the wireless carriers.

<sup>5</sup>GNSS, or Global Navigation Satellite System, is the generic term that refers to satellite systems used for global navigation and includes the Global Positioning System (GPS) operated by the United States, the Galileo system operated by the European Union, the GLONASS system operated by the Russian Federation, and the BeiDou system operated by the People’s Republic of China.



Figure 1 provides a simplified diagram for collecting, delivering, and using 9-1-1 location information. These processes may be performed by an entity responsible for deriving the location information (Point A), an entity responsible for conveying that information to the PSAP (Point B), and the PSAP itself (Point C). The process may also include various third-party service providers and/or software and hardware vendors working for, or under contract to, the PSAP.

**Figure 1: Generic 9-1-1 Location Data Delivery Process**



As mentioned above, certain wireless carriers are already using DBH-derived information in the location data they pass to the PSAP. In this context, Point A might represent Apple’s HELO or Google’s ELS, Point B represents the wireless carrier (together with the entity under contract to provide Mobile Positioning Center [MPC]/Gateway Mobile Location Center [GMLC] functionality), and Point C is the PSAP. Point C would include 9-1-1 call handling, Computer Aided Dispatch (CAD), and other systems used by the PSAP to process, analyze, and archive 9-1-1 calls and associated location information. Prior to delivering the 9-1-1 location information to the PSAP, the wireless carrier or supplemental 9-1-1 location data provider may perform a validation process to provide a sanity check on the accuracy of the location information. Carriers may also utilize multiple location techniques to estimate the location, and if such location is believed to be better, it may provide that location to the PSAP in place of a DBH-based location.

The process for providing supplemental 9-1-1 location data to the PSAP can vary from the traditional wireless carrier process in several ways:

1. The 9-1-1 location provider (Point B) would be some entity other than the wireless carrier.
2. Today, the supplemental 9-1-1 location data providers deliver the location information directly to PSAP systems.
3. The 9-1-1 location data originator (Point A) for each process may be the same, e.g., Apple’s HELO or Google’s ELS, but the method for delivering the location information to the supplemental 9-1-1 location data provider would be different.





Wireless carriers provide PSAPs with 9-1-1 call location information that includes three types of information: (a) the estimated location of the caller; (b) confidence level; and (c) an uncertainty value. Uncertainty values are represented as a search area around the estimated location (e.g., a circle of radius x) based on a defined level of confidence. In accordance with FCC Rules, wireless carriers always provide 9-1-1 location information to PSAPs with a radius of uncertainty that is based on a confidence level of 90%. This standardization enables 9-1-1 Telecommunicators to consistently evaluate location information regardless of the wireless carrier serving the 9-1-1 caller. Confidence levels and uncertainty values employed by supplemental 9-1-1 location data providers may be different. As a result, when comparing 9-1-1 location information provided by different sources, PSAPs must take into account the confidence levels and uncertainty values provided by each.

## **B. Potential Benefits of Supplemental 9-1-1 Location Data**

Regardless of how it's provided, the benefits of accurate and timely location information to a PSAP's emergency response efforts are numerous. It allows 9-1-1 Telecommunicators to spend less time determining and validating location information and allows first responders to get to those in need more quickly. Supplemental 9-1-1 location data may be helpful at any time, but it might be especially helpful when traditional methods for determining location don't provide a location that is sufficiently accurate based on estimated uncertainty or if traditional location methods don't provide an accurate location fix in a timely manner. With supplemental 9-1-1 location data available as an option, PSAPs and 9-1-1 authorities would be empowered to make their own choices about which technological solutions fit their specific needs.

Fortunately, location technologies available on smartphone devices and operating systems have improved greatly in recent years and continue to improve. While these technologies may be leveraged by carrier-based solutions, the availability of supplemental 9-1-1 location solutions may accelerate their adoption by PSAPs. Moreover, as PSAPs transition to NG9-1-1, the use of supplemental 9-1-1 location data may provide PSAPs with another tangible benefit of deploying IP-based systems that can receive location data beyond the traditional E9-1-1 ANI and ALI. The benefits associated with the availability of supplemental 9-1-1 location data may be a key reason to upgrade outdated 9-1-1 call-handling applications, mapping products, or computer-aided dispatch software.

## **C. Potential Challenges of Supplemental 9-1-1 Location Data**

As with any innovation, supplemental 9-1-1 location data is not without its challenges. While the majority of mobile devices are capable of sending supplemental 9-1-1 device location data, not every mobile device is currently enabled to do this (e.g., devices without a data connection or SMS), and some device manufacturers, networks, and/or operating system developers may not choose to support it. Even when a device is enabled, there is no assurance that the supplemental location data will be available for every 9-1-1 call sent to the PSAP. Moreover, not every PSAP is currently equipped to receive and use supplemental 9-1-1 location data if it were available. As with traditional



Phase I and Phase II wireless location services, PSAPs must take steps to make use of available 9-1-1 location information. In order to take advantage of supplemental 9-1-1 location data, PSAPs must opt in to the service.

These issues should not be viewed as impediments. However, they are issues that should be recognized by PSAPs as they consider whether or not to make use of supplemental 9-1-1 location data.

#### **D. Relationship to Next Generation 9-1-1**

Next Generation 9-1-1 systems are designed to both deliver caller location information to the PSAP with the 9-1-1 call and use the location information for call routing control. While the latter is not yet available, the features of the NG9-1-1 Core can be used to access supplemental location information, process it, and deliver it to PSAPs through standard NG9-1-1 connections.<sup>6</sup> This should be supported regardless of whether that location data is acquired from originating carriers or from supplemental 9-1-1 location data providers, using the Additional Data access feature or other points within the NG9-1-1 Core system. However, there must be a mechanism to distinguish carrier-provided 9-1-1 location data from supplemental 9-1-1 location data.

## **SECTION 4: BEST PRACTICES FOR SUPPLEMENTAL 9-1-1 LOCATION DATA PROVIDERS**

This section describes recommended best practices for those entities that provide supplemental 9-1-1 location data to PSAPs. It includes guidelines affecting the accuracy of supplemental data, how such data is determined and conveyed to PSAPs, and what policies, procedures, and processes should be implemented by location service providers to address cybersecurity, privacy, and other important issues.

### **A. Location Information**

Locations should be reported to the PSAP in a geodetic profile (latitude/longitude with altitude when possible, along with uncertainty radius and confidence) along with a reliable time stamp of when the location was determined. The recommended confidence for geodetic locations is 90% to facilitate direct comparison with traditional wireless carrier location mechanisms. Any deviations from 90% should be clearly communicated to the PSAP.

If a reverse-geocoded address is provided, it should be labeled as “Estimated Address” to indicate that the address might be imprecise. The process of reverse-geocoding a geodetic address should ideally use the best available high-integrity data (e.g., site/structure address points, road centerlines, or site/structure parcel polygons). If possible, the civic address portion of the estimated address should be validated against MSAG or another validation function (e.g., an NG9-1-1 validation function such as LVF).

<sup>6</sup>NENA Standard for NG9-1-1 Additional Data NENA-STA-012.2-2017



## B. Caller Interaction

Location should be automatically conveyed to the PSAP without requiring 9-1-1 callers to go through manual steps to send location that could distract callers from the conversation with the 9-1-1 Telecommunicator or delay the call itself.

## C. Timing

Location should be sent as soon as a position is acquired that satisfies the uncertainty and confidence outlined in this document, and location updates should be sent periodically throughout the call without requiring a rebid, and especially whenever the caller is in motion. Location should be sent with reliable time stamps to alert users of potentially stale locations.

## D. Cybersecurity

Providers should follow common cybersecurity best practices such as end-to-end encryption, strong authentication schemes, and secure transport mechanisms. Mechanisms should be in place to identify and prevent spoofing of location data.

## E. Privacy

Providers should ensure that 9-1-1 location information can be universally obtained only in association with an active 9-1-1 call. Locations obtained outside of a 9-1-1 call should require explicit user consent.

## F. Stakeholder Notification

Providers of supplemental 9-1-1 location data should voluntarily notify stakeholders such as federal regulators, industry organizations, 9-1-1 authorities, and wireless carriers, as appropriate, when conducting tests, implementing significant software changes, and/or implementing any supplemental location solution. Stakeholders should be provided with any relevant information about their solutions, including any operational limitations associated with their location data.

## G. NG9-1-1 Standards

Providers should design their services to support NG9-1-1 standards by supporting NENA i3 procedures, data flow, data structures, interfaces, functional elements, and services, such as Location Information Service (LIS), HTTP Enabled Location Delivery (HELD) and Presence Information Data Format – Location Object (PIDF-LO) when transmitting supplemental location data to PSAPs.<sup>7</sup> The implementation of a specific standard or communications mechanism should be sought with industry interoperability in mind, though standards compliance is ultimately at the discretion of the PSAP for the delivery of emergency calls and data.

<sup>7</sup>See <https://www.nena.org/page/Standards>





## H. Terms of Use

Providers should provide clear, written “terms of use” to their Public Safety customers or contracted entity to clarify how supplemental location data can or cannot be used. Providers should be able to explain to their Public Safety customers how the location data provided is acquired and conveyed to PSAPs, as well as any limitations on the availability of supplemental 9-1-1 location data (e.g., if the subscriber is not subscribed to data services, if the call is from a non-service initialized device, if the supplemental information is determined with a non-standard confidence level).

## SECTION 5: BEST PRACTICES FOR PSAPs

This section describes recommended best practices for use by PSAPs that choose to use supplemental 9-1-1 location data in conjunction with their traditional 9-1-1 call-handling processes. It includes guidelines for using supplemental 9-1-1 location data in conjunction with location data received through traditional mechanisms, as well as best practices affecting location data display, workflow integration, and training. PSAPs will also likely need to incorporate the use of supplemental 9-1-1 location data into their standard operating procedures, and new policies and procedures may need to be developed.

### A. Administrative Issues

#### i. Supplemental 9-1-1 Location Data Provider Qualifications

PSAPs and 9-1-1 Authorities should ensure that any entities providing supplemental 9-1-1 location data are able to meet several basic qualifications. They should be able to demonstrate that they are reputable, financially stable and meet all applicable legal and regulatory requirements. They should also be able to demonstrate that they meet i3 and other applicable industry standards and should demonstrate an understanding of how NG9-1-1 implementation will change the delivery of location information in the future. Because the use of supplemental 9-1-1 location data may require changes to CPE, PSAPs and 9-1-1 Authorities should be cognizant about how their decision to use such data will impact their long-term CPE plans.

#### ii. Legal/Liability Risks

PSAPs should evaluate potential legal/liability risks that may arise because of using supplemental 9-1-1 location data technology and services.

#### iii. Regulatory Requirements

PSAPs should ensure their supplemental 9-1-1 location data provider meets all applicable regulatory requirements at the federal, state and local levels.





#### **iv. Contracts, Terms of Use, and NDAs**

It is important to align expectations between the PSAP and supplemental 9-1-1 location data provider. These expectations should be documented and should include how the supplemental 9-1-1 location is identified, what notifications are given when supplemental data is not available, and a clear designation of responsibilities between the PSAP, supplemental 9-1-1 location data provider, and any other entities in the delivery chain. Service level agreements, assignment of liability, recordkeeping and data retention, data ownership and evidence production policies, and other related issues should be enumerated in any contracts or agreements. Any third party and sub-contractor relationships should be transparent and identified in the contract or agreement.

A supplemental 9-1-1 location data provider may require that a PSAP or 9-1-1 Authority enter into a Terms of Use or End User License Agreement (EULA). A EULA might specify the authorized use of the data and any limitations to the information provided. Such agreements should be clearly understood and should be evaluated to assess legal/liability risk.

Because of the proprietary nature surrounding the supplemental location technology or service employed, the PSAP may have to enter into a Non-Disclosure Agreement (NDA) with the vendor providing the service. It is important that an NDA does not unnecessarily limit the PSAP's operations and that issues of indemnity and public and legal release of information are clearly addressed.

## **B. Technical Issues**

The NENA i3 architecture for NG9-1-1 provides for a LIS to hold and provide caller location data.<sup>8</sup> It also includes an Additional Data Repository (ADR) associated with an Additional Data query process for acquiring various data relevant to a 9-1-1 call or message. Either of these mechanisms could be employed to access supplemental 9-1-1 location data as available at the beginning or during a call, and from more than one point in the overall NG9-1-1 process for either routing control, delivery to PSAPs, or both.

If IP is available from the NG9-1-1 Core to the PSAP, the ability to access 9-1-1 location data from any server acting as a LIS or through the NG9-1-1 ADR feature would allow delivery of all location information via the IP links to all connected PSAPs, rather than requiring a separate data path into each PSAP.

If a supplemental 9-1-1 location data provider employs a separate data path (such as to the call handling system, the CAD, or a mapping system), that path might contain specific (non-NG9-1-1) access points and software to accept and process the additional location data. The public safety planner/decision maker should consider that, with NG9-1-1, there is no need for these separate

<sup>8</sup>See NENA Detailed Functional and Interface Standards for the NENA i3 Solution  
[https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/NENA-STA-010.2\\_i3\\_Architectu.pdf](https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/NENA-STA-010.2_i3_Architectu.pdf)



arrangements. The public safety planner / decision maker must balance the immediate and timely availability of supplemental data through such integrations against the cost and potential schedule of the NG9-1-1 transition.

The NG9-1-1 common path from originator to PSAP contains numerous designed capabilities for Privacy and Security, Quality Control, and High-availability. Supplemental data providers should ensure acceptable capabilities for the same.

## C. Operational Issues

### i. Standard Operating Procedures (SOPs)

The use of supplemental 9-1-1 location data by a PSAP will likely require changes to the SOPs employed by the center in receiving, handling, and processing 9-1-1 calls. Potential changes should be considered well in advance of employing a supplemental 9-1-1 location service.

### ii. Software Systems and Workflow Integration

PSAPs should ensure that software systems and applications integrate supplemental 9-1-1 location data into existing workflows and displays, such as 9-1-1 call handling systems, mapping solutions, CAD, or other PSAP systems. The addition of supplemental 9-1-1 location information should not impair the Telecommunicator's ability to view and process 9-1-1 location information in a timely manner.

Supplemental 9-1-1 location data should be queried automatically rather than requiring a manual request by the Telecommunicator. Where direct integrations are not immediately available, PSAPs should evaluate the benefit to public safety in adopting manual query mechanisms until such integrations are implemented.

PSAPs should collaborate with their software systems providers to ensure their applications display supplemental 9-1-1 location data in a manner that enables the Telecommunicator to make an efficient and informed dispatch decision based on all sources of location information provided including traditional 9-1-1 location data and supplemental 9-1-1 location data.

The User Interface should be designed to place displayed supplemental location in full context (e.g., indicating the relative age or time stamp of the location and whether the user is viewing the most recent location information). If multiple locations associated with the same call but from different sources (e.g., carrier and supplemental 9-1-1 location data provider) are present, these should be presented to the Telecommunicator together with each location clearly differentiated (e.g., one





not overwriting the other). If presented graphically, the locations should be overlaid with clear and complete information about the source of the location data, time of delivery, and associated uncertainty (or “search area”) at the same level of confidence for each.

Regarding confidence values, PSAPs should ensure that their software systems and applications display supplemental 9-1-1 location data with horizontal uncertainty measured as a search area around a reported point. All supplemental location information delivered as a position should convey confidence at 90%. If a confidence value other than 90% is conveyed by the provider of supplemental 9-1-1 location services, the confidence value should be displayed as well. PSAPs should exercise caution in making judgments about the accuracy of supplemental 9-1-1 location data that may utilize different confidence levels, and should require location data be displayed at a 90% confidence level for ease of comparison. In any event, Telecommunicators are advised to continue to rely on their training and their ability to question the caller regarding his/her location.

Notably, no location estimation technique is perfect, and any technique may result in significant errors (e.g., a call made from Idaho with a location given in Colorado). Even if such instances are rare, reliance on locations with significant errors could have drastic impacts on emergency response efforts. Therefore, PSAPs should compare any estimated location data to Phase I location data (cell site location), as this is a known location.

It is recommended that reverse geo-coding of a coordinate-based position into a civic address only be done using the best-available high-integrity data (e.g., site/structure address points, road centerlines, or site/structure parcel polygons). If a supplemental location is being displayed as a reverse-geocoded address, it should be labeled as an “estimated address” to encourage Telecommunicators not to immediately trust the address, and to verify the address information.

### **iii. Call Logging and Records Management**

Supplemental 9-1-1 location data received by the PSAP should be associated with the call or incident record in all call and incident handling systems and logged by the PSAP’s logging recorder(s) and service(s). Supplemental 9-1-1 location data should be clearly distinguishable from ALI Location by using different symbology.

### **iv. Trouble Reporting**

Trouble reporting procedures should be discussed, agreed upon, and documented in the service agreement between the PSAP/9-1-1 Authority, the supplemental 9-1-1 location data provider, and any associated PSAP system vendor. For integrated solutions, PSAPs/9-1-1 Authorities should contact their vendors in line with their existing support arrangements for trouble reporting. As an integrated solution, the supplemental location data is just a feature inside of a product that PSAPs/9-1-1 Authorities purchased (e.g., 9-1-1 call handling, CAD, mapping), and it is covered by



existing trouble reporting procedures. It would be up to the 9-1-1 Authority and the vendor to engage the supplemental 9-1-1 location data provider for assistance in trouble shooting a problem. PSAPs should not contact a wireless service provider for issues related to supplemental location data that is provided separately from the traditional wireless location data.

For non-integrated solutions such as those provided by a web browser, PSAPs should contact the supplemental 9-1-1 location data provider for support.

#### **v. Training**

PSAPs should train staff and update SOPs to provide guidance on topics related to the use of supplemental 9-1-1 location data including:

- Basic concepts of caller location (e.g., civic address vs. lat/lon, uncertainty, confidence);
- Differences between supplemental 9-1-1 location data and location data from other sources (e.g., civic addresses, wireless Phase 1 and Phase 2, NEAD-based location, etc.);
- When and how to use supplemental 9-1-1 location data (e.g., when carrier-provided data is not sufficient to locate the caller);
- How to validate location if different sources yield inconsistent results; and
- How to properly report location discrepancies.

#### **vi. Quality Assurance**

PSAPs should periodically analyze and audit the locations of wireless 9-1-1 calls over periods of time to compare the speed and accuracy of traditional wireless locations to supplemental locations, to determine patterns, update training, and to work with traditional and supplemental 9-1-1 location data providers to correct problems to improve the accuracy and performance of traditional and supplemental location solutions.

