

**Before the United States Senate
Committee on Commerce, Science, and Transportation
Subcommittee on Communications, Technology, and the Internet**

LOCATING 9-1-1 CALLERS IN A WIRELESS WORLD

January 16th, 2014

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Summary

1. The mobile revolution has driven a rapid consumer exodus from wireline service and explosive growth in indoor wireless use: more than 38% of all households are now wireless-only.
2. Wireless calls now account for more than 70% of all 9-1-1 traffic.
3. In some jurisdictions, as many as 50% of wireless 9-1-1 callers can provide no useful location information by voice.
4. Even where callers can provide *some* location information, latitude/longitude information is still used to assign and route field responders.
5. Some data suggest that carriers may not always meet their existing location performance obligations.
6. The Committee should support an FCC inquiry to determine whether carriers currently meet their obligations, and, if not, why.
7. Existing FCC rules do not require *any* ability to locate wireless callers when they dial 9-1-1 from indoors.
8. Technologies that are already in the market on a competitive basis can provide sufficiently improved outdoor location performance and sufficiently meaningful indoor location performance to justify their adoption.
9. The Committee should support an FCC rulemaking to begin the phase-in of indoor location performance requirements.

Testimony

Chairman Pryor, Ranking Member Wicker, and may it please the Committee: My name is Trey Forgety,¹ and on behalf of NENA: The 9-1-1 As-

¹I joined NENA: The 9-1-1 Association in 2010 after two years as a Presidential Management Fellow in the Department of Homeland Security (DHS) Office of Emergency Communications. During my fellowship, I served temporarily with the Federal Communications Commission's (FCC) Public Safety and Homeland Security Bureau and with the Department of Commerce's National Telecommunications and Information Administration (NTIA). At the FCC, I developed recommendations for the Public Safety chapter of the National Broadband Plan. Later, at Commerce, I worked to implement the Plan's recommendations as NTIA evaluated applications to the Broadband Technology Opportunity Program (BTOP). Both at NTIA and DHS, I participated in discussions with senior administration officials from the Office of the Vice President, the Office of Management and

sociation's more than 7,000 public- and private-sector members, I want to thank you for holding this hearing. Providing emergency response service is perhaps *the* core function of government, and 9-1-1 is the crucial first link between the public and emergency responders. I would also like to thank Senators Klobuchar and Burr for their leadership as the Senate Co-Chairs of the Congressional NextGen 9-1-1 Caucus, and Senator Boxer for her membership in the Caucus. All too frequently, we hear "public safety" described only in terms of field-response disciplines like law enforcement, fire, and EMS, so it is particularly meaningful that you and the other members of the Caucus have dedicated yourselves to ensuring that 9-1-1 is consistently recognized as a co-equal component of the public safety community. I am pleased, too, to be here today with representatives of the public safety radio community, the cellular industry, disability advocacy organizations, and technology providers. From consumer to telecommunicator to dispatcher, to field responder, each of these communities plays an important role in ensuring that emergency response services are available, accessible, effective, and reliable for everyone.

Since the establishment of the first official night watch at Boston in 1631, local governments throughout our country have worked diligently to ensure that all people can reach help in their moments of need. In 1968, that work culminated in the establishment of a unified emergency telephone number for all emergencies: 9-1-1. Over the years, 9-1-1 service evolved from little more than a call-forwarding destination to a system that was, for its time, remarkable in its sophistication and ubiquity. Enhanced 9-1-1 systems, introduced in the 1980s, can not only route calls to the correct local Public Safety Answering Point, but can also provide a call-back number in case a caller hangs up and display the address of the home or office building from which a call originates. As time marched on, however, new technologies radically reshaped the ways in which the public communicates. The '80s and '90s brought us a mobile revolution unimaginable only a decade before, and transformed the cellular telephone from an expensive, heavy luxury into a affordable, tiny, and ubiquitous means of communication.

As the mobile revolution unfolded, it presented a series of challenges to consumers, public safety agencies, and the nascent industry. Access to 9-1-1, call-back capability to deal with dropped calls, and caller location were all areas of significant technical and policy disagreement. One by one, these challenges were overcome, however, thanks to strong and unwavering voices from the public and the public safety community, and, in key instances, from industry leaders willing to do the right thing. Here, I would be remiss if I did not highlight the contribution of FCC Chairman Tom Wheeler: It was he who, as then-President of CTIA: The Wireless Association, engaged with NENA's then-President Mary Boyd to conclude an agreement on wireless E9-1-1 location capabilities that are the subject of today's hearing. Without visionary leaders like Chairman Wheeler and

Budget, the Office of Science and Technology Policy, and the National Economic Council to develop policies for the deployment of the nationwide mobile broadband network for first responders, now known as FirstNet. I hold a Bachelor of Science in Applied Physics and a Doctor of Jurisprudence, both from the University of Tennessee.

Mrs. Boyd, the United States might have succumbed to the forces of fear, uncertainty, and doubt, and lost valuable time in establishing wireless as a primary consumer technology. Even today, when mobile devices are used for everything from hailing a cab to ordering dinner, the sense of safety and security consumers derive from carrying a mobile device remains a key motivator for service adoption – a motivator premised on the ability of the consumer to reach 9-1-1 and of the 9-1-1 center to dispatch help.

In order to effectively respond to emergencies, 9-1-1 centers must be able to tell field responders *where* to go. The basic technologies, like GPS, which make that possible are now more than twenty years old, a lifetime in today's technology cycle. Yet there are still circumstances in which 9-1-1 centers cannot locate callers who, rightly and reasonably, believe that when they call, they can be found. Understanding that belief is critically important: In preparing for today's hearing, I spoke with PSAP managers from several jurisdictions around the country. In Pennington County, South Dakota, for example, approximately 10-15% of callers can provide no useful location information at all. These callers typically fall into one of two categories: tourists visiting Mount Rushmore or hiking in the Black Hills, and travelers transiting the I-90 corridor. Even for callers who can provide some information, location coordinates still play a very important role: In 50-70% of calls, the caller is unable to provide a precise, dispatchable address. Examples of this type of call include tourists in hotels, hunters, who may only be able to describe the location where they parked based on a single road, farmers working in fields that are not associated with addressed structures, and patrons of shopping complexes calling from parking lots. In those cases, the caller's information can sometimes be used to initially mobilize response assets, while the precise latitude and longitude are used to provide a final destination while the assets are in route. Outside South Dakota, the problem can be even worse in some areas. For example, in Horry County, South Carolina (home to Myrtle Beach and the "Grand Strand"), sixty miles of beaches, fertile riparian soils, and popular inland hunting grounds place millions of visitors, hundreds of farmers, and thousands of hunters in remote or unfamiliar territory every day. There, as many as 50% of callers cannot provide meaningfully precise location information. Consequently, dispatchers must resort to asking about nearby landmarks or waiting for latitude/longitude data. And, of course, for millions of individuals with hearing or speech disabilities, voice 9-1-1 calls (the only kind that can currently be made in all but ~20 jurisdictions), do not afford *any* opportunity to supply information, location or otherwise. To solve these problems and facilitate a public safety response, the FCC requires wireless carriers to implement location determination technology in their networks or subscriber handsets. Data derived from those systems can then be used by local Enhanced 9-1-1 systems to locate callers in need.

Wireless Enhanced 9-1-1 is deployed in two formally-defined phases, with an informal "Phase 0" added for the sake of completeness. Phase 0 permits wireless callers to reach a 9-1-1 center and provides only a call-back number in case a call drops. Phase I allows the 9-1-1 system to look up the address of the cell tower serving the caller, and in many cases the

cardinal or inter-cardinal bearing along the center of the sector to which the caller's device is attached (e.g., N, W, NE, SW, etc.). Phase II allows the 9-1-1 system to request more precise location information related to the caller's device, rather than the cell, and can provide the telecommunicator with an estimate of the caller's latitude and longitude coordinates.²

PSAPs and 9-1-1 authorities must affirmatively request each phase of service from each carrier serving their jurisdiction once they have deployed the hardware, software, and training required to accept and handle each new form of location information. Additionally, in many states, PSAPs must pay carriers to provide the requested service out of state- and locally-collected 9-1-1 fees, often with no audit or capital amortization requirements. In those states much of the revenue collected in 9-1-1 fees each year never reaches local 9-1-1 centers because it is paid directly back to the carriers. As state legislatures have raided 9-1-1 funds as a quick fix for short-term budget problems, these dual pressures have left some local PSAPs contemplating a previously unthinkable reduction in service from Phase II to Phase I or less. While such a reduction would preserve core 9-1-1 operations, it would also place countless lives at risk as PSAPs and field responders struggled to locate callers without an address or lat/long coordinates. Yet while PSAPs face dual pressures reducing their funding, carriers reap a dual benefit to their revenues: Carriers sell consumer location data, often derived from the very same hardware and software that supports E9-1-1 operations, as part of Commercial Location-Based Services offerings, generating almost \$1 billion in revenues per year.³ Given the dual revenue stream E9-1-1 location systems have created for carriers in some states, then, it seems reasonable that the public should expect not only assurances of adequate location performance, but also concrete data to support those assurances. Until recently, however, public safety agencies have lacked both the ability to collect and analyze data on carrier network performance on their own. And although the FCC's basic Wireless E9-1-1 location accuracy rules have been in place for more over 12 years now, and localized county- or PSAP-level performance rules have since been promulgated, neither has the Commission collected any data on real-world carrier location performance. That paucity of data, however is no longer the rule.

² In all cases, wireless 9-1-1 calls are routed to a Public Safety Answering Point based on fixed database entries that link each cell sector with a pre-selected PSAP, regardless of where a caller may be in that sector. That is, if a sector spans a jurisdictional boundary, all calls will go to the assigned PSAP, even if it does not actually serve the caller's location. One estimate, based on an extensive routing study conducted in California, puts the fraction of sectors with central-bearing errors between 90° and 180° at 10%. Of course, not all such errors will necessarily result in misrouted calls: only those sectors that subtend an area encompassing a jurisdictional boundary will be subject to such errors. Consequently, states like Texas and Tennessee, which have a large number of sub-state administrative boundaries will likely experience a larger number of errors, while states like Nevada and Colorado, which have a smaller number of administrative boundaries, will likely experience fewer, assuming the California findings are consistent across network deployments in areas of varying jurisdictional density.

³ Mobile Location-Based Services, 7th ed., Research and Markets (Feb. 2013) (available at <http://www.researchandmarkets.com/research/36fd44/mobile>).

The advent of “big data” analytics systems has begun to offer the public safety community a glimpse into the world behind the curtain. As PSAPs have deployed advanced Management Information Systems (MIS), call-data monitoring platforms, and cutting-edge analytics and visualization systems, they have gained insight into the apparent performance of entire E9-1-1 systems, including wireless networks. Here, it is important to emphasize that the data available to PSAPs is *apparent* data: It reflects the reality experienced by the front-line 9-1-1 telecommunicators responsible for answering calls on a daily basis, and does not include visibility into the records, interfaces, or flows of calls and data that lie strictly within carriers’ networks. Nonetheless, it is the apparent data which matter: Telecommunicators cannot dispatch help based on information that never reaches them. As these apparent data have become available, they have raised myriad questions and legitimate concerns throughout the 9-1-1 community.

Over the Summer CalNENA, the independent chapter of my organization that serves the state of California, released data which appeared to show two causes for concern: First, the data showed a surprisingly small fraction of wireless 9-1-1 calls for which Phase II latitude and longitude data were displayed to the telecommunicator by the end of the call. Second, the data showed a long-term secular down trend in the fraction of calls for which Phase II latitude and longitude data were displayed to the telecommunicator by the end of the call for all but one of the four largest wireless carriers. Since that time, additional states and localities have filed data with the FCC, some of which supports the CalNENA findings, and some of which does not. After reviewing all publicly-available data in concert with the carriers, CalNENA officials, analytics experts, and NENA’s own technical experts, we discovered several issues that could potentially explain, at least in part, the low overall apparent performance of the carrier networks, as well as the apparent down trend in the fraction of calls with Phase II data.

First, we discovered that the apparent down-trend in Phase II availability could be explained, at least in part, by an industry-wide transition away from older “network based” location technology to newer “handset based” technology. Network based location systems have historically used Location Measurement Units (LMUs) situated on cell towers to listen for precisely-timed transmissions from mobile devices. Based on the speed of light in air and certain other known properties of radio signal propagation, these units could then combine 3 or more distance measurements to estimate the location of the caller’s device. This approach can provide a very fast “Time To First Fix,” but only at the expense of producing a lower-accuracy estimate of position. Newer handset-based solutions, by contrast, can produce much more accurate position estimates, but take a longer time to acquire a fix as they must “listen” for signals from lower-powered satellite transmitters (e.g., GPS, GLONASS). Because PSAP equipment typically makes an initial request or “bid” for Phase II location data at a fixed time after a call is connected, the transition from fast but less accurate technologies to slower but more accurate ones could have produced the trend observed by CalNENA in the absence of a timing change at the PSAPs. This would have lowered apparent location

yield early in calls, but potentially improved location accuracy once a fix was obtained later in calls.

Second, we discovered that long-since overcome technical challenges associated with certain early CDMA handsets, coupled with erroneous beliefs about carrier charges for location update requests or “re-bids” had led to a widespread policy against the use of automatic re-bids. This policy may have prevented the PSAPs involved in the CalNENA study from receiving Phase II location information when it might otherwise have been available, thus lowering carrier’s apparent rate of Phase II location delivery. Consequently, it could be assumed that reinstating automatic rebids would raise the apparent fraction of calls for which Phase II location information is available.

Third, we believe that fundamental changes in consumer use patterns for mobile devices could be driving down the fraction of calls for which Phase II location information can be estimated. As originally envisioned in the FCC’s rules and incorporated into wireless network architecture, location determination obligations were premised on callers using mobile devices outdoors. At the time, mobile airtime was expensive, the vast majority of consumers still had landlines at home and at work, and cellular devices were still thought of as “car phones.” It was therefore logical to assume that such devices would be used primarily outdoors on roads and highways. Now, however, mobile devices have become the default and landline use has declined precipitously. In its place, almost 40% of consumers rely solely on wireless devices for their everyday communications needs, including access to 9-1-1.⁴ Indeed, most 9-1-1 centers report that more than 70% of all calls they receive originate from wireless devices. It follows, then, that a higher fraction of calls now originate from indoors locations where landline calls would previously have dominated. Because this state of affairs could not have been anticipated at the time the rules were implemented, it has caught consumers, public safety, carriers, and technology providers somewhat off-guard.

I wish to emphasize, however, that it is still possible that none of these explanations may fully explain the discrepancy between the levels of location performance reported by many carriers after the CalNENA filing and the levels found in the CalNENA study. To date, carriers’ assertions of aggregate performance levels have not included disclosures of the underlying data which might allow public safety agencies or the FCC to fully evaluate their claims. This is a key point: NENA has been unable to locate any record of a location performance audit conducted by the FCC since that agency first adopted its location accuracy rules in 2001. Carriers routinely report that they are in compliance with their location performance obligations. They may well be. But while NENA believes the general level of location performance to be decent, the experience of front-line telecommunicators, anecdotal though it may be, paints a concerning picture of real-world results. NENA therefore supports a policy of “trust,

⁴ Blumberg, Stephen J., Ph.D., & Luke, Julian V., Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, July-December 2012, Division of Health Interview Statistics, National Center for Health Statistics, Centers for Disease Control and Prevention (Jun. 2013) (available at: <http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201306.pdf>).

but verify.” To that end, we strongly support the establishment of a meaningful disclosure and monitoring regime to ensure that these critical public safety service obligations are met consistently throughout the United States. Whether such a regime is established through cooperative efforts between NENA and the carriers or by the FCC, I sincerely hope we find that they are.

All of this debate about whose data says what and how it should be interpreted, however, is, to some extent, beside the point: Ultimately, what matters to the public safety community and to consumers is whether a caller can be accurately located when she or he calls for help. Circumstances today are very different than they were in 2001. New technologies are already in the market, ready to compete, and can provide improved location capabilities that reach inside homes and businesses to the places where consumers use mobile devices today. As mobile networks move into the 21st century with advanced broadband data capabilities and high-accuracy location technologies for consumer applications, it is critical that we ensure 9-1-1 systems are not left behind. Now, anticipation and speculation about a potential indoor location requirement may be holding back carrier investments in improved location technology.

Over the past year, the FCC investigated the potential of several new or improved technologies through a rigorous test-bed process conducted through the Communications Security Reliability and Interoperability Council or “CSRIC.” CSRIC is a Federal Advisory Committee composed primarily of carrier and technology vendor representatives, but which also includes a few public safety representatives. As part of the test bed, CSRIC retained the services of a neutral, third-party testing company to ensure competing location technologies would be evaluated on a thorough and fair basis.⁵ The results of the CSRIC trials were clear: All three technologies subjected to testing could permit some degree of indoor location performance for some morphologies, and two of the three showed significant improvements over existing capabilities across all morphologies (e.g., urban, rural, etc.).⁶ Likewise, a fourth solution provider that did not participate in the initial round of testing later submitted to the test bed’s scrutiny and also demonstrated the ability to provide meaningful location information for callers in indoor environments. And, lest these be thought the only technologies available, companies as diverse as Apple, Boeing, and John Deere have also introduced location technologies that could be leveraged for 9-1-1 purposes.

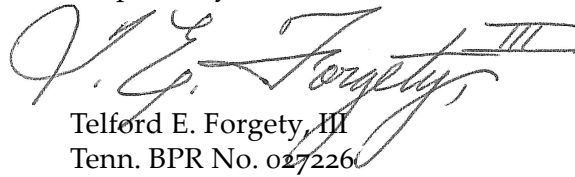
Because the market for new and improved location technology has proven its ability to better meet the needs of the public safety community on a competitive basis, NENA is convinced that the time for study is at an end: While we support the continued operation of the CSRIC test bed as a means to provide unbiased evaluations of new technologies willing to endure its rigors, we do not believe that its existence should become a perpetual excuse for delay. The public and the public safety community

⁵ CSRIC Working Group IV: E9-1-1 Location Accuracy Indoor Location Test Bed Report (Mar. 14, 2013) (available at: http://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRIC_III_WG3_Report_Mar_ch_%202013_ILTestBedReport.pdf).

⁶ *Id.* at 35-36.

need improved location performance – both outdoors and in – today. Every moment we delay the start of those improvements lives, property, and productivity are needlessly lost. We therefore encourage the Committee to support immediate FCC action to establish indoor location performance targets and a concrete timeline for their implementation.

Respectfully submitted,

A handwritten signature in black ink, reading "T. E. Forgety, III". The signature is written in a cursive style with a horizontal line at the end.

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