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The First Responder Network (FirstNet) and Next-Generation Communications for Public Safety: Issues for Congress

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Summary

Since September 11, 2001, when communications failures contributed to the tragedies of the day, Congress has passed several laws intended to create a nationwide emergency communications capability. Yet the United States has continued to strive for a solution that assures seamless communications among first responders and emergency personnel at the scene of a major disaster. To address this problem, Congress included provisions in the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96) for planning, building, and managing a new, nationwide, broadband network for public safety communications (FirstNet), and assigned additional radio frequency spectrum to accommodate the new network. In addition, the act has designated federal appropriations of over $7 billion for the network and other public safety needs. These funds will be provided through new revenue from the auction of spectrum licenses. These and other public safety and spectrum provisions of the act appear in Title VI, known as the Public Safety and Spectrum Act, or Spectrum Act.

There are many challenges for public safety leaders and policy makers in establishing the framework for a nationwide network that meets state, local, and tribal needs for robust, interoperable emergency communications. For example, emergency communications networks currently operate on separate networks using different technologies. Because public safety planning has lagged behind commercial efforts to build next-generation wireless networks, the work on design and development of technical requirements for a public safety broadband network is incomplete. Furthermore, each state has its own laws and procedures for building, managing, and funding its network. Establishing a governance model that accommodates current investments and future needs without compromising the coherence of a national network is another challenge. The cost of construction of a nationwide network for public safety is estimated by experts to be in the tens of billions of dollars over the long term, with similarly large sums needed for maintenance and operation. In expectation that private sector participation in building the new network will reduce costs to the public sector, the law has provided some requirements and guidelines for partnerships, access to spectrum, and shared use of infrastructure. Identifying and negotiating with potential partners is another challenge for the new network, as is establishing a revenue stream to fund operations and future investments.

These and other challenges are potential barriers to the success of the new network. To meet them in a timely manner may require significant investments in human resources in the early stages of the network. Therefore, yet another challenge to success may arise from federal hiring requirements and the release of funds to cover salaries and expenses while FirstNet is in start-up mode.

In addition to monitoring progress in building the new broadband network for public safety, Congress may want to consider reviewing the role of commercial networks in emergency response and recovery. Once commercial communications lines are compromised because of infrastructure failures, interdependent public safety networks are threatened and the ability to communicate vital information to the public is diminished. New policy initiatives may be needed to identify critical gaps in communications infrastructure and the means to fund the investments needed to close these gaps.

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Introduction

The importance of wireless communications in emergency response has expanded in parallel with increasing reliance on mobile communications across all sectors of the American economy. The consequences of failure in emergency communications networks have also grown, as the nation witnessed on September 11, 2001, and in the days that followed, as first responders and other emergency workers struggled to communicate with each other. The need for robust emergency communications was again underlined by network failures in the wakes of Hurricanes Katrina and Rita, in 2005. Fixing the problems of communications interoperability and operability that hampered response and recovery in these and other catastrophic events has been and remains a long-term goal of policy makers.

After September 11, many experts recognized that a first responder communications network with national coverage would provide the standards and connectivity needed for interoperability and survivability. The National Commission on Terrorist Attacks Upon the United States (9/11 Commission) also recognized the role of networks in providing interoperability, citing the Army Signal Corps as a possible model in recommendations to Congress.[1]

From 2002 through 2007 Congress passed several laws intended to provide the Department of Homeland Security with the tools to plan for a national network. Efforts fell short of congressional expectations, however, in part because federal resources were directed to maintaining local jurisdiction in decision-making at the expense of coordinating a nationwide network.[2]

With the passage of the "Spectrum Act," Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96) on February 22, 2012, the Administration, Congress, the public safety sector, and many other stakeholders have come together to begin the process of developing, constructing, and operating a nationwide network designed to meet public safety communications needs. The act has given government agencies and public safety officials new tools for providing nationwide availability of state-of-the art communications capability for emergency response and recovery. A new network is to be built to provide broadband communications "on a single, national network architecture that evolves with technological advancements."[3] The act requires that recommended minimum technology standards be based on commercial Long Term Evolution

[1] Discussed in Congressional Research Service General Distribution Memorandum, "Communications Support for Public Safety: The 9/11 Commission Report and Alternative Approaches," by Linda K. Moore, August 25, 2004, and in CRS Report RL31375, *Emergency Communications: Meeting Public Safety Spectrum Needs* by Linda K. Moore, 2002-2003 (out of print; available from the author).

[2] Some of the actions by Congress and by federal agencies were summarized in testimony by Linda K. Moore, Specialist in Telecommunications Policy, Congressional Research Service, before the House Committee on Homeland Security, Subcommittee on Emergency Preparedness, Response, and Communications, "Ensuring Coordination and Cooperation: A Review of Emergency Communications Offices Within the Department of Homeland Security," November 17, 2011. The GAO has also addressed these issues in reports such as *Emergency Communications: Various Challenges Likely to Slow Implementation of a Public Safety Broadband Network*, February 2012, GAO-12-343 at http://www.gao.gov/assets/590/588795.pdf. CRS reports on the topic include CRS Report R41842, *Funding Emergency Communications: Technology and Policy Considerations*; CRS Report R40859, *Public Safety Communications and Spectrum Resources: Policy Issues for Congress*; CRS Report RL34054, *Public-Private Partnership for a Public Safety Network: Governance and Policy*; CRS Report RL33838, *Emergency Communications: Policy Options at a Crossroads*, all by Linda K. Moore.

[3] P.L. 112-96, Section 6202 (b).

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(LTE).[4] LTE is a fourth-generation wireless technology that bases its operating standards on the Internet Protocol (IP). IP-enabled networks and wireless devices provide higher capacity and transmission speeds than earlier generations of technology. It is generally believed that the use of LTE and IP standards will greatly enhance communications for emergency response and recovery.

The initial network features specified in the act are consistent with LTE network architectures but might be applied to other technologies introduced for wireless communications. One of the limitations of LTE standards is that they are based on earlier cellular networks and do not take full advantage of the Internet.[5] Therefore, although compatibility with current and evolving commercial LTE technology is deemed by most to be essential for the early stages of its development, FirstNet is not limited to LTE or LTE Advanced. The emphasis in the Spectrum Act appears to be on tapping the innovative energy of the commercial sector to assure that the most effective technologies are available to public safety agencies, to serve the safety of the public.

The initial phases of the FirstNet network deployment will most likely use LTE for transmitting data and video content only. Mission critical voice communications using standards designed for Land Mobile Radio (LMR) will be carried on separate networks. In time, many anticipate that IP standards for radios will replace LMR, bringing new economies of scale and higher levels of performance. The development of unified communications technologies to provide a national network places the nation on the path to achieve the long-sought goal of robust, interoperable communications for first responders.

Key Provisions in the Spectrum Act to Improve Public Safety Communications

A national program to provide nationwide coverage for public safety communications is to be developed and managed by a new federal entity, the First Responder Network Authority, or FirstNet. FirstNet has been established by the act and given broad powers to ensure that the nationwide public safety broadband network is built, maintained, and kept up-to-date as technology evolves. In consultation with federal, state, local, and tribal authorities, FirstNet will develop proposals to construct and manage the network with partners from the private sector, among others. Following is a discussion of major provisions in the act that pertain to public safety communications, including provisions to improve the nation's 911 emergency call system.

Among federal agencies designated by the act to provide consultation and support are the Federal Communications Commission (FCC), the National Telecommunications and Information Administration (NTIA), the National Institute of Standards and Technology (NIST), and the Office of Emergency Communications (OEC). The FCC manages commercial and non-federal spectrum use, including spectrum allocated to public safety. The NTIA manages federal spectrum resources and, along with NIST, is an agency within the Department of Commerce. OEC is part of the Office of Cybersecurity and Communications, Department of Homeland Security.

[4] P.L. 112-96, Section 6203 (c) (2).

[5] "Directions for future cellular mobile network architecture," by Byoung-Jo J. Kim and Paul S. Henry, First Monday: Peer-Reviewed Journal on the Internet, December 3, 2012, http://firstmonday.org/ojs/index.php/fm/article/view/4204.

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Spectrum Assignment

Radio frequency spectrum is an essential resource for wireless communications. The energy in electronic telecommunications transmissions converts airwaves into signals to deliver voice, text, and images. These signal frequencies are allocated for specific purposes, such as television broadcasting or WiFi,[6] and assigned to specific users through licenses. Allocating sufficient spectrum for wireless emergency communications has long been a concern for Congress. The Balanced Budget Act of 1997 (P.L. 105-33), for example, directed the FCC to allocate 24 MHz[7] of spectrum in the 700 MHz band for public safety use.[8]

With the passage of the Spectrum Act, some existing public safety licenses in the 700 MHz band[9] and an additional license (known as the D Block),[10] together totaling 22 MHz, have been designated by Congress to support a broadband communications network for public safety. As required by the act, the initial, 10-year license to use these frequencies was assigned by the FCC to FirstNet. It is renewable for an additional 10 years, on condition that FirstNet has met its duties and obligations under the act.[11]

A total of 34 MHz of spectrum capacity will therefore be available for public safety networks within the 700 MHz band: the 22 MHz designated for broadband, and 12 MHz allocated for narrowband communications, primarily voice.[12] Additionally, there are public safety networks on adjacent frequencies within the 800 MHz band. Time and technological advances may someday bring these spectrum assets together, but at present there are three distinct public safety network technologies in use or planned within the 700 MHz and 800 MHz bands. These are: broadband communications at 700 MHz; interoperable narrowband communications at 700 MHz; and narrowband communications at 800 MHz. Some of the narrowband networks at 700 MHz and 800 MHz can share infrastructure and radios but older narrowband networks at 800 MHz are often not easily integrated with narrowband networks being built on 700 MHz frequencies.

All of the 700 MHz band spectrum allocated for public safety use can support broadband networks. At present, however, there is no tested technology to deliver voice communications over LTE broadband that meets first responder requirements. The act gives the FCC the authority to "... allow the narrowband spectrum to be used in a flexible manner, including usage for public safety broadband communications.... "subject to technical and interference protection measures.[13] This provision might open an opportunity for early broadband network build-outs by public safety agencies that want to be in the vanguard of using LTE voice communications technology.

[6] WiFi, for wireless fidelity, operates on unlicensed frequencies that are not assigned to a specific owner but instead are available to support any device approved by the FCC.

[7] Spectrum is segmented into bands of radio frequencies and typically measured in cycles per second, or hertz. Standard abbreviations for measuring frequencies include kHz—kilohertz or thousands of hertz; MHz—megahertz, or millions of hertz; and GHz—gigahertz, or billions of hertz. The 700 MHz band includes radio frequencies from 698 MHz to 806 MHz.

[8] 47 U.S.C. §309 (j) (14).

[9] 763-768 MHz, 793-798 MHz, 768-769 MHz and 798-799 MHz.

[10] 758-763 MHz and 788-793 MHz; P.L. 112-96, Section 6001, (2).

[11] P.L. 112-96, Section 6201.

[12] 769-775 MHz and 799-805 MHz.

[13] P.L. 112-96, Section 6102.

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The act requires that public safety users return frequencies known as the T-Band.[14] These are frequencies between 470 and 512 MHz allocated for television that have been made available for public safety use in 11 urban areas.[15] Since the transition to digital television, radio transmissions on some of these frequency assignments have experienced interference and the public safety agencies that use them are considering moving to new networks at 700 MHz. Other areas have recently invested to upgrade networks built on the T-Band frequencies and are concerned about the loss of this communications capacity. The act requires that the FCC act by February 2021 to establish a relocation plan that would free up the T-Band for reassignment through competitive bidding. Proceeds from the auctions of T-Band frequencies are to be available for grants to cover relocation costs.[16] There are no requirements in the law as to how the NTIA, the designated grants administrator, is to structure the grant program or determine eligible costs, although the agency might decide to follow procedures for reallocating federal spectrum.

Some of the earliest spectrum assignments for public safety are in channels below 512 MHz. Public safety and other license-holders in designated channels below 512 MHz are required to reband their holdings to conform to an FCC mandate to improve spectrum efficiency.[17] This narrowbanding requirement, as it is called, requires that assigned channels be reduced from a width of 25 khz to 12.5 khz, thereby freeing up new spectrum capacity for public safety and other uses. The deadline to meet the narrowbanding requirement was January 1, 2013. To accommodate public safety license holders in the T-Band that now fall under requirements established in the act, the FCC has ruled to exempt them from the narrowbanding requirements.[18]

Although not specifically required by the act, several federal agencies have broad powers to undertake research and development that might further goals for improved performance of emergency communications systems, as well as more efficient and effective use of all spectrum resources allocated for public safety use. Many policy makers believe that additional technological development and planning should be undertaken, although FirstNet's mandate appears to limit it to the public safety broadband network to be operated on the spectrum licensed to it.

Expenditures and Revenue Sources

The cost of building a new wireless communications network is likely to be in the tens of billions of dollars.[19] To meet these costs, the expectation is that FirstNet will have access to existing infrastructure for some of the network's components and that it will be able to invest through partnerships—with commercial wireless carriers or other secondary users of its spectrum and infrastructure—that generate revenue.

[14] P.L. 112-96, Section 6103.

[15] Metropolitan areas: Boston, MA, Chicago, IL, Dallas/Fort Worth, TX, Houston, TX, Los Angeles, CA, Miami, FL, New York, NY/Newark NJ, Philadelphia, PA, Pittsburgh, PA, San Francisco/Oakland, CA, and Washington, DC.

[16] The National Public Safety Telecommunications Council (NPSTC) prepared a report that provided an overview of T-Band assignments, some of the problems created by the act's requirements, and possible alternative solutions. NPSTC, *T-Band Report*, March 15, 2013; link to PDF at http://www.npstc.org/, "NPSTC Releases T Band Report."

[17] Details at http://transition.fcc.gov/pshs/public-safety-spectrum/narrowbanding.html.

[18] FCC, "Waiver of Narrowbanding Deadlines for T-Band (470-512 MHz) Licenses," Docket No. WT 99-87, released April 26, 2012.

[19] Some cost estimates for building and operating a public safety broadband network are provided in CRS Report R41842, *Funding Emergency Communications: Technology and Policy Considerations*, by Linda K. Moore.

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The Spectrum Act provides over $7 billion in funding directed to FirstNet and to states, either as direct transfers or as grants. There is an initial loan of $2 billion (repayable from spectrum-license auction proceeds) to set up FirstNet and begin its operation.[20] The remaining $5 billion will become available as auctions for spectrum licenses are concluded and the revenues deposited in the Public Safety Trust Fund.

Public Safety Trust Fund

The law provides for transfers from a Public Safety Trust Fund, which is established in the Treasury by the act, to receive revenues from designated auctions of spectrum licenses.[21] The designated amounts are to remain available through FY2022, after which any remaining funds are to revert to the Treasury, to be used for deficit reduction. Auction proceeds are to be distributed in the following order of priority:

- To the NTIA, to reimburse the Treasury for funds advanced to cover the initial costs of establishing FirstNet: not to exceed $2 billion.
- To the State and Local Implementation Fund for a grant program: $135 million.
- To the Network Construction Fund for costs associated with building the nationwide network and for grants to states that qualify to build their own networks: $7 billion, reduced by the amount advanced to establish FirstNet.
- To NIST for public safety research: $100 million.
- To the Treasury for deficit reduction: $20.4 billion.
- To the NTIA and the National Highway Traffic Safety Administration for a grant program to improve 911 services: $115 million.
- To NIST for public safety research, phase two: $200 million.
- To the Treasury for deficit reduction: any remaining amounts from designated auction revenues.

Network Construction Fund

The Network Construction Fund is established in the Treasury to be used by FirstNet for expenditures on construction, maintenance, and related expenses to build the nationwide network required in the act; by the NTIA to make payments to states that are participating in FirstNet; and by the NTIA for grants to those states that qualify to build their own radio access network links.[22]

[20] P.L. 112-96, Section 6207.

[21] P.L. 112-96, Section 6413.

[22] P.L. 112-96, Section 6206 (e).

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FirstNet: Limit on Expenditures

The act caps FirstNet's administrative expenses at $100 million in total over the first 10 years of operation. Costs attributed to oversight and audits are not included in the expense cap.[23]

FirstNet: Fee Income and Other Revenue

Congress gave FirstNet the authority to obtain grants, and to receive payment for the use of network capacity licensed to FirstNet and of network infrastructure "constructed, owned, or operated" by FirstNet.[24] Specifically, FirstNet is authorized to collect network user fees from public safety and secondary users[25] and to receive payments under leasing agreements in public-private partnerships.[26] These partnerships may be formed between FirstNet and a secondary user for the purpose of constructing, managing, and operating the network. The agreements may allow access to the network on a secondary basis for services other than public safety.[27] The act requires that these fees be sufficient each year to cover annual expenses of FirstNet to carry out required activities,[28] with any remaining revenue going to network construction, operation, maintenance, and improvement.[29] There is a prohibition on providing service directly to consumers; this does not impact the right to collect fees from a secondary user or enter into leasing agreements.[30]

State and Local Implementation Fund

The State and Local Implementation Fund was allocated $135 million from the Public Safety Trust Fund. The NTIA, which administers the grant program for this fund, may borrow up to the full amount.[31] The grants are to be made available to all 56 states and territories to develop a plan on how to use a nationwide public safety broadband network to meet their emergency communications needs. The program is to be established as a matching grant program. Federal grants from the fund are not to exceed 80% of the projected cost to the state, however, the NTIA may make the decision to waive the matching funds requirement.[32] The distribution of available funds among the states will be established by the NTIA in consultation with FirstNet.[33]

The NTIA subsequently decided to plan for funding in two phases. The first phase will provide funding for initial planning and related activities. The deadline for completed applications for phase one was March 19, 2013. The second phase will address states' needs in preparing for additional consulting with FirstNet, and for planning to undertake data collection activities.[34]

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[23] P.L. 112-96, Section 6207 (b).

[24] P.L. 112-96, Section 6206 (b) (4).

[25] P.L. 112-96, Section 6208 (a) (1).

[26] P.L. 112-96, Section 6208 (a) (2).

[27] P.L. 112-96, Section 6208 (a) (2) (B).

[28] P.L. 112-96, Section 6208 (b).

[29] P.L. 112-96, Section 6208 (d).

[30] P.L. 112-96, Section 6212.

[31] P.L. 112-96, Section 6301.

[32] P.L. 112-96, Section 6302 (b).

[33] P.L. 112-96, Section 6302 (a).

[34] Announcement of Federal Funding Opportunity at http://www.ntia.doc.gov/files/ntia/publications/
(continued...)

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Expenditures by the NTIA from the State and Local Implementation Fund were reported at $300,000 for FY2012 for administrative costs. Disbursements for administrative costs and grants funding are estimated at $124,958,000 (base) for FY2013 and $9,700,000 for FY2014.[35]

The announced amount available for the first phase of grants from the fund is $121.5 million.[36] Grants totaling over $116 million were awarded to 54 of the 56 eligible states and territories in FY2013.[37] The state of Louisiana and the territory of the Northern Mariana Islands did not receive grants.[38] Many of the grants will be used to bolster existing state programs for public safety communications and interoperability, and for outreach and education.

Other Sources of Funds

The construction of this new network represents a significant investment for all participants. State public safety agencies have multiple obligations to build, upgrade, and equip other networks and may not be in a position to contribute to building and maintaining the new broadband network. The ability of FirstNet to procure funding from the private sector may be crucial to its success.

Planning Authority

The Spectrum Act created FirstNet as an independent entity within the NTIA. FirstNet is required to plan for and establish an interoperable broadband network for public safety. The act requires that state and local agencies and tribal authorities have a consulting role in the development, deployment, and operation of the nationwide network. The act further provides an opportunity for states to plan and build their own radio access networks within the framework of the nationwide broadband network.[39]

FirstNet

When Congress creates an independent entity within the federal government, it may have the obligation to achieve a specific goal, usually within a specific time frame.[40] As an independent entity, FirstNet—the First Responder Network Authority—has been given both goals and timeframes. It has been instructed by Congress to exercise all powers specifically granted by the

(...continued)

sligp_ffo_02062013.pdf.

[35] U.S. Department of Commerce, National Telecommunications and Information Administration, FY2014 Budget as Presented to Congress, April 2013; State and Local Implementation Fund, Exhibit 10.

[36] NTIA, "NTIA Announces Availability of $121.5 Million in State Grants to Assist with FirstNet Planning," February 6, 2013 (http://www.ntia.doc.gov/press-release/2013/ntia-announces-availability-1215-million-state-grants-assist-firstnet-planning) and "State and Local Implementation Grant Program Federal Funding Opportunity," February 6, 2013 (http://www.ntia.doc.gov/other-publication/2013/sligp-federal-funding-opportunity).

[37] NTIA Press release, "More than $116 Million Awarded to Assist States in FirstNet Planning," September 26, 2013, http://www.ntia.doc.gov/press-release/2013/more-116-million-awarded-assist-states-firstnet-planning.

[38] NTIA, SLIGP Awards, http://www.ntia.doc.gov/sligp/sligp-awards.

[39] Current information on FirstNet's activities, including network design and state planning, is available at http://www.firstnet.gov.

[40] For examples, see CRS Report RS22230, *Congressional or Federal Charters: Overview and Enduring Issues*, by Kevin R. Kosar.

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act and "such incidental powers as shall be necessary"[41] to create a nationwide broadband network for public safety. Unless renewed, this authority expires in 2027.[42] The law requires FirstNet to become a self-funding entity, independent of government subsidies.[43] FirstNet is to take "all actions necessary to ensure the building, deployment, and operation" of the network in consultation with federal, state, tribal, and local public safety entities, the Director of NIST, the FCC, and the public safety advisory committee.[44] FirstNet appears therefore to be an autonomous organization, with broad powers to carry out its mandate, within the requirements established by the law. It has, for example, sole power to select the program's manager and its agents, consultants, and other experts subject to the requirement that they be chosen "in a fair, transparent, and objective manner."[45] However, FirstNet, except for certain exemptions provided in the act, must follow federal agency requirements, notably in hiring and procurement, slowing down the process for establishing FirstNet as a going concern.[46]

FirstNet is to be headed by a board of 15 members of which 12 are appointed by the Secretary of Commerce according to criteria established by the law, which are intended to provide both representation from key stakeholders and expertise. The other three members of the board are designees of the Secretary of the Department of Homeland Security, the Attorney General of the United States, and the Director of the Office of Management and Budget. The Secretary of Commerce is required to appoint a chairman of the board for an initial term of two years.[47] Initial appointments to the board were announced on August 20, 2012.[48]

As part of its management of the network, FirstNet is required, at a minimum:

- To establish network policies, including development of detailed requests for proposals to build the network, and operational matters such as terms of service and billing practices.[49]
- To consult with states on network-related expenditures, as part of the preparation of policies and requests for proposals.[50]
- To enter into agreements to use existing communications infrastructure, including commercial and federal infrastructure, "to the maximum extent economically desirable."[51]

[41] P.L. 112-96, Section 6206 (a) (1).

[42] P.L. 112-96, Section 6206 (f).

[43] P.L. 112-96, Section 6208.

[44] P.L. 112-96, Section 6206 (b) (1).

[45] P.L. 112-96, Section 6205 (b) (1).

[46] Hearing, House Committee on Energy and Commerce, Subcommittee on Communications and Technology, "Oversight of FirstNet and the Advancement of Public Safety Wireless Communications," testimony of Samuel Ginn, Chairman, FirstNet, November 21, 2013.

[47] P.L. 112-96, Section 6204.

[48] Announcement and background information at http://www.ntia.doc.gov/other-publication/2012/acting-secretary-rebecca-blank-announces-board-directors-first-responder-netw.

[49] P.L. 112-96, Section 6206 (c) (1).

[50] P.L. 112-96, Section 6206 (c) (2).

[51] P.L. 112-96, Section 6206 (c) (3).

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- To ensure the construction, maintenance, operation, and improvement of the broadband network, taking into account new and evolving technologies.[52]
- To enter into agreements with commercial networks to allow public safety roaming on their networks.[53]
- To represent the interests of the network's users before standards-setting boards, in consultation with NIST, the FCC, and its own Public Safety Advisory Committee.[54]

FirstNet is required to create a public safety advisory committee to assist in carrying out its mandate.[55] There are no requirements in the statute as to the composition of the committee. By-laws adopted at the organizing meeting of the First Net Board of Directors on September 25, 2012 created a Public Safety Advisory Committee.[56] It was further agreed that the members of the committee would be chosen from the Advisory Committee to SAFECOM, within the Department of Homeland Security, to be chosen in consultation with the Secretary of Homeland Security. The organizations chosen to be represented on the committee were announced on February 20, 2013.[57] State and local government interests are represented through a subcommittee of PSAC.

State and Local Participation

Every state has one or more agencies that plan for public safety, homeland security, and emergency communications. Most states have a Statewide Interoperability Coordinator (SWIC) to administer its Statewide Communication Interoperability Plan (SCIP).[58] SCIPs are written to conform with federal guidelines and requirements, such as the National Emergency Communications Plan. FirstNet is required to consult with regional, state, tribal, and local authorities regarding decisions such as those concerning the costs of the policies it formulates, as required in the law, including expenditures for the core network, placement of towers, coverage areas, security, and priority access for local users. Consultation will be through a state-selected coordinator as specified in the act.[59] Appointment of an individual or governmental body as the point-of-contact is also required as a condition of state participation and eligibility to receive grants established by the act.[60]

States may decide to use the existing SWIC as the required single point-of-contact or may choose to appoint a separate coordinator. Each state and other participants have successfully appointed a coordinator to work directly with FirstNet.[61]

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[52] P.L. 112-96, Section 6206 (c) (4).

[53] P.L. 112-96, Section 6206 (c) (5).

[54] P.L. 112-96, Section 6206 (c) (7).

[55] P.L. 112-96, Section 6205 (a).

[56] Board Resolution 1, By-Laws, http://www.ntia.doc.gov/files/ntia/publications/firstnet_resolution_no._1_on_bylaws_adopted_9.25.12.pdf.

[57] NTIA, "FirstNet Names members of Public Safety Advisory Committee," February 20, 2013, http://www.ntia.doc.gov/press-release/2013/firstnet-names-members-public-safety-advisory-committee.

[58] See "Statewide Interoperability Coordinators" at http://www.dhs.gov/files/programs/gc_1286986920144.shtm.

[59] P.L. 112-96, Section 6206 (c) (2) (B).

[60] P.L. 112-96, Section 6302 (d).

[61] Hearing, House Committee on Energy and Commerce, Subcommittee on Communications and Technology, (continued...)

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The governor of each state is to be notified by FirstNet when it has completed its requests for proposals regarding construction, operation, maintenance, and improvement of a nationwide network. The governor or his designee will receive the details of the proposed plans and notification of the amount of funding available to the state if it participates in the FirstNet program.[62]

A state that does not want to participate in FirstNet's deployment plan for radio access networks must submit an alternative plan for construction, operation, maintenance, and improvement of the radio access network within the state. The state must demonstrate to the FCC, which the law requires to review the plan, that its planned radio access network would comply with minimum technical requirements and be interoperable with FirstNet. The state has 90 days to agree to participate or to notify FirstNet, the NTIA, and the FCC of its intent to deploy its own part of the radio access network, and an additional 180 days to provide its plan to the FCC.[63]

If the FCC does not approve the plan, the state might be obliged to participate in FirstNet.[64] If a state's plan is approved it will be eligible to apply for a grant, administered by the NTIA, that will be funded from the Network Construction Fund created by the act. The amount available may be less than what would have been provided if the state had opted in to the FirstNet program, because the grant will be applied only toward building the radio access network and may be subject to matching grant requirements. Approval of the grant is contingent on meeting additional requirements established by the NTIA, including sustainability, timeliness, cost-effectiveness, security, coverage, and services that are comparable to FirstNet.[65] The state would be required to pay a user fee for access to FirstNet's core network.[66] It would not be permitted to enter commercial markets or lease access to its network except through a public-private partnership. Any revenue to the state from a partnership must be used only for costs associated with its broadband network.[67]

Some industry observers have expressed concern about the impact on the success of the nationwide broadband network if many states choose to build their own radio access networks. The cost to FirstNet of building the nationwide network may go up, for example, if anticipated economies of scale are diminished. It may be more difficult for FirstNet to negotiate the partnerships that are expected to provide much of the needed funding for the network. A state that has its plans approved by the FCC may not be able to meet stipulated requirements when its network is built; absent any action by the FCC to enforce technical requirements, the goal of seamless interoperability across all broadband systems may be jeopardized. States operating within and outside the FirstNet deployment plan may, over time, have difficulty in finding the funds to complete radio access network build-outs, leaving significant gaps in what is intended to be nationwide coverage.

(...continued)

"Oversight of FirstNet and the Advancement of Public Safety Wireless Communications," testimony of Samuel Ginn, Chairman, FirstNet, November 21, 2013. List of state contacts at http://firstnet.gov/sites/default/files/SPOC_list_03102014.pdf.

[62] P.L. 112-96, Section 6302 (e) (1).

[63] P.L. 112-96, Section 6302 (e) (2) and (3).

[64] P.L. 112-96, Section 6302 (e) (3) (C) (iv).

[65] P.L. 112-96, Section 6302 (e) (3) (D).

[66] P.L. 112-96, Section 6302 (f).

[67] P.L. 112-96, Section 6302 (g).

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The act only identifies two options for a state: join FirstNet or build a statewide radio access network subject to the provisions of the act. The act does not include specific provisions for a state that chooses to build its own radio access network without opting out of FirstNet, although providing such an option may be within FirstNet's charter. A state might, for example, choose to build its own data management center or mobile access routers while also sharing FirstNet's infrastructure for regional and national coverage. The act also is silent on whether states may choose to opt-out of the broadband network entirely, choosing neither to join FirstNet nor to build a broadband network on the frequencies assigned to FirstNet. Some states may prefer to concentrate their resources on improving mission-critical voice networks and acquire broadband access from a commercial provider or through other means.

On the other hand, there are many benefits for independent action by individual states and regional partnerships of two or more states. For example, LTE networks are relying increasing on small cell architectures[68] that are organized around local nodes. This configuration might correspond with local jurisdictions, potentially providing better interoperability with the core network, while reducing capital investment in infrastructure. One advantage for states building their own radio access networks on FirstNet spectrum is that they will have greater control over any partnerships formed and on expenditures within their states. Although the act requires states to use any revenue from partnerships only to cover costs associated with the state's network, the states will be able to make their own decisions about priorities, with more confidence that revenues will be available when needed.

Although there are many potential benefits for states to participate in a nationwide network, such as economies of scale, more secure and robust communications, and a unified base for collaborative efforts, there are also a number of risks, especially if FirstNet fails to deliver promised benefits. The success of FirstNet as an accepted planning authority and leader may depend on whether it makes a compelling business case in the requests for proposals required by the act.

FirstNet's plans for partnerships with the private sector and the nature of the network development plans proposed to each state may be of particular interest to Congress as an early indicator of the viability of FirstNet in meeting the goals required by the act.

Federal Governance

Federal governance of the nationwide public safety broadband network, as required by the Spectrum Act, is primarily through consultation and oversight. Planning, investment, operations, and other related decisions are to be made by the FirstNet board and the experts it is to hire on a permanent or consultative basis.

Statutory Obligations

Examples of statutory obligations for Congress and the Administration in the direction of FirstNet include the following.

[68] Small cells are low-powered radio access nodes that are used to boost capacity and manage network interference and connectivity. They can support LTE cellular networks in configurations that include or emulate unlicensed WiFi standards for Wide Area Networks (WAN).

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Membership on FirstNet board. The members of the FirstNet board are to be chosen by the Secretary of Commerce, within the parameters established in the act. The Department of Homeland Security, the Attorney General, and the Office of Management and Budget each have one member on the board in permanence. The Secretary of Commerce is required to appoint a chairman of the board for an initial term of two years.[69]

Grant programs for planning. The NTIA is to establish and administer the State and Local Implementation Fund. Grant provisions are to be decided in consultation with FirstNet,[70] but not necessarily in accordance with decisions made by the FirstNet board and executive management.

Grant programs for state networks. The NTIA is to administer grants from the Network Construction Fund to states that qualify to build their own radio access networks and choose to apply for a grant.[71]

Funding for FirstNet and participating states through the Network Construction Fund. The NTIA is to determine the funding level available to each state for the buildout of the nationwide broadband network, if the state chooses to participate in FirstNet.[72]

Spectrum leases for state networks. The NTIA sets the terms and is responsible for enforcing the requirement that states qualifying to build their radio access networks must sublease spectrum through FirstNet, the assigned license-holder.[73]

License review. The FCC is required to review the initial 10-year license assigned to FirstNet and consider its renewal based on performance criteria.[74]

Performance review. The Government Accountability Office (GAO), within 10 years, is to prepare a report providing recommendations on "what action Congress should take" regarding the mandated termination of authority of FirstNet in 2027.[75]

Fee schedule. The NTIA is to review and approve the annual schedule of fees charged to public safety agencies and other users for access to FirstNet's resources.[76]

Annual audit. The Secretary of Commerce is to contract for an annual audit of FirstNet's finances and activities. The reports are to be submitted to Congress, the President, and FirstNet.[77]

Report to Congress. FirstNet is required to submit annual reports to Congress on its "operations, activities, financial conditions, and accomplishments."[78]

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[69] P.L. 112-96, Section 6204.

[70] P.L. 112-96, Section 6302 (a).

[71] P.L. 112-96, Section 6302 (e) (3) (C) (iii) (I).

[72] P.L. 112-96, Section 6302 (e) (1) (C).

[73] P.L. 112-96, Section 6302 (e) (3) (C) (iii) (II).

[74] P.L. 112-96, Section 6201 (b).

[75] P.L. 112-96, Section 6206 (g).

[76] P.L. 112-96, Section 6208 (c).

[77] P.L. 112-96, Section 6209.

[78] P.L. 112-96, Section 6210.

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The designated appropriate congressional committees are, in the Senate, the Committee on Commerce, Science, and Transportation; in the House, the Committee on Energy and Commerce.[79] These committees and other committees with jurisdiction are likely to take an active role in oversight, many believe.

Although there are several platforms for oversight and guidance provided in the act, it seems likely that the primary, day-to-day responsibility for monitoring progress will fall to the NTIA. Agency discretion for funding states that participate in FirstNet and for providing grants to states that opt out is authorized by the act. The $7 billion grant to the Network Construction Fund is implicitly divided into three parts: one funding FirstNet to establish the network; one funding states that participate in FirstNet; and one funding states that choose to opt out. Clauses that may have been intended to oversee state expenditures might be construed by the NTIA to include FirstNet. The act, however, does not provide guidance to the NTIA on how to balance fiduciary caution with entrepreneurial initiative in assuring a flow of funds to FirstNet.

Public-Private Partnerships

Partnerships are expected to play a critical role in building and operating the network. Electric utility companies, for example, are upgrading their networks to meet Smart Grid requirements,[80] and some companies have expressed an interest in partnering with FirstNet or state authorities. Some commercial wireless service providers have also expressed an interest in working in partnership with public safety entities to develop and operate new broadband networks.

The Spectrum Act requires FirstNet to issue "open, transparent, and competitive" requests for proposals to private sector entities for building, operating, and maintaining the network[81] that leverage to the extent "economically desirable" existing commercial wireless infrastructure, in order to expedite network deployment.[82] It is charged with managing and overseeing the resulting contracts or agreements. As part of a separate requirement to assure substantial rural coverage during all phases of deployment, the act requires that industry proposals and contracts include, if possible, partnerships with existing commercial mobile providers.[83]

Decisions by FirstNet about the network's design, construction, and operation are likely to have a significant impact on commercial participation in a public safety broadband network or networks. These decisions may also influence decision-making by states as to whether or not to pursue radio area network construction independently or through their own partnerships.

Congress may be interested in the composition of private sector partnerships formed by FirstNet and individual states, not only for their business plans but also for the inclusion of a wide variety of stakeholders. For example, are rural and tribal wireless carriers included as business partners? Do secondary access agreements support services that meet social goals, such as for telemedicine,

[79] P.L. 112-96, Section 6001 (3).

[80] "Smart Grid" is the name given to the evolving electric power network as new information technology systems and capabilities are incorporated. See also CRS Report R41886, *The Smart Grid and Cybersecurity—Regulatory Policy and Issues*, by Richard J. Campbell.

[81] P.L. 112-96, Section 6206 (b) (1) (B).

[82] P.L. 112-96, Section 6206 (b) (1) (C).

[83] P.L. 112-96, Section 6206 (b) (3).

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or are they exclusively for commercial purposes? Is competition in providing wireless services being enhanced or hindered?

Infrastructure

Infrastructure for the new network includes operations centers, towers, antennae, base stations, routers, small cell nodes, and other communications equipment, as well as radios and the software that links them to the network. For wireless communications, an important infrastructure component is the connection between base stations and communications backbones. These networks, which usually operate over fiber-optic cable or microwave connection, are typically referred to as backhaul.

The Spectrum Act requires FirstNet to establish a nationwide, interoperable public safety network.[84] Network infrastructure components that are specifically required include

- Core network of national and regional data centers and other elements, all based on commercial standards.
- Connectivity between the radio access network and the public Internet or the Public Switched Telephone Network, or both.
- Network cell site equipment, antennas, and backhaul equipment, based on commercial standards, to support wireless devices operating on frequencies designated for public safety broadband.[85]

FirstNet is required to leverage existing infrastructure by entering into agreements to use commercial or other communications infrastructure, including federal, state, tribal, or local infrastructure.[86] Planned phases for infrastructure deployment are to include "substantial rural coverage."[87]

FirstNet's ability to build the required network may depend on the timeliness, scope, and outcome of its negotiations to share infrastructure with other parties in order to focus resources on providing elements deemed essential for public safety use of broadband communications.

Timeframe

The requirements of the Spectrum Act must be substantially met and the viability of the project demonstrated no later than the end of FY2022, if not sooner. The State and Local Implementation Fund and the Network Construction Fund expire in 2022, with any balances reverting to the Treasury. By 2022, the GAO must have assessed the performance of FirstNet and provided a report to Congress; and the FCC must decide whether or not to renew the licenses for the public safety broadband network. Within this 10-year timeframe, there are few deadlines beyond requirements for the initial establishment of the planning and implementation framework.

[84] P.L. 112-96, Section 6202 (a).

[85] P.L. 112-96, Section 6202 (b).

[86] P.L. 112-96, Section 6206 (c) (3).

[87] P.L. 112-96, Section 6206 (b) (3).

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Many of the important steps for building the network have no required deadline. Some milestones, such as rural coverage, are mandated in the act, but the deadlines are not specified. There are, for example, no deadlines in provisions that require FirstNet to:

- Develop requests for proposals that include a requirement for timetables.[88]
- Consult with states on establishing state and local planning processes.[89]
- Complete the request for proposal process that is to be given to each state governor regarding the request for proposal and its details, and the funding level for each state as determined by the NTIA.[90]

Mandated deadlines for states include

- Within 90 days of receipt of notice from FirstNet, the governor shall choose either to participate in deployment of FirstNet or to conduct its own radio access network deployment within the state.[91]
- Within 180 days of giving notice to opt out of FirstNet, the governor shall complete requests for proposals for a state network.[92]

No deadline is established in the statute for the FCC to approve or disapprove state proposals for their own portion of the nationwide broadband network.[93] There are also no specified deadlines for a state to apply to the NTIA for a grant to construct the radio access network and to lease spectrum capacity from First Net, if FCC approval is received for a state network.[94] However, one condition of eligibility for a grant to a state to build its own radio access network is that the state's plan must demonstrate "the ability to complete the project within specified comparable deadlines.... "[95]

FirstNet and the FCC may need to be expeditious in completing all steps for the preparation, review, and acceptance of requests for proposals so that construction of the required core network begins in a timely manner. Too many delays in administrative processes may erode the feasibility of the project.

The FirstNet Board may opt to provide additional requirements for timelines and goals that coordinate their own efforts with those of the FCC, the NTIA, state agencies, and other stakeholders. In particular, consideration may be given to modifying timelines to accommodate states' own time lines, for example, for budget approvals.

[88] P.L. 112-96, Section 6206, (c) (1).

[89] P.L. 112-96, Section 6206, (c) (2).

[90] P.L. 112-96, Section 6302 (e) (1).

[91] P.L. 112-96, Section 6302, (e) (2).

[92] P.L. 112-96, Section 6302, (e) (3) (B).

[93] P.L. 112-96, Section 6302 (e) (3) (C) (i).

[94] P.L. 112-96, Section 6302, (e) (3) (C) (iii).

[95] P.L. 112-96, Section 6302, (e) (3) (D) (i) (III).

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Next Generation 9-1-1

Today's 911 system is built on an infrastructure of analog technology that does not support many of the features that most Americans expect to be part of an emergency response. Efforts to splice newer, digital technologies onto this aging infrastructure have created points of failure where a call can be dropped or misdirected, sometimes with tragic consequences. Callers to 911, however, generally assume that the newer technologies they are using to place a call are matched by the same level of technology at the 911 call centers, known as Public Safety Answering Points (PSAPs). However, this is not always the case. To modernize the system to provide the quality of service that approaches the expectations of its users will require that the PSAPs and state, local, and possibly federal emergency communications authorities invest in new technologies. As envisioned by most stakeholders, these new technologies—collectively referred to as Next Generation 911 or NG9-1-1—should incorporate Internet Protocol standards. An IP-enabled emergency communications network that supports 911 will facilitate interoperability and system resilience; improve connections between 911 call centers; provide more robust capacity; and offer flexibility in receiving and managing calls. The same network can also serve wireless broadband communications for public safety and other emergency personnel, as well as other purposes.

Recognizing the importance of providing effective 911 service, Congress has previously passed three major bills supporting improvements in the handling of 911 emergency calls. The Wireless Communications and Public Safety Act of 1999 (P.L. 106-81) established 911 as the number to call for emergencies and gave the Federal Communications Commission (FCC) authority to regulate many aspects of the service. The most recent of these laws, the NET 911 Improvement Act of 2008 (P.L. 110-283), required the preparation of a National Plan for migrating to an IP-enabled emergency network. Responsibility for the plan was assigned to the E-911 Implementation Coordination Office (ICO), created to meet requirements of an earlier law, the ENHANCE 911 Act of 2004 (P.L. 108-494). Authorization for the ICO terminated on September 30, 2009. ICO was jointly administered by the National Telecommunications and Information Administration and the National Highway Traffic Safety Administration.

Spectrum Act provisions re-establish the federal 9-1-1 Implementation Coordination Office (ICO) to advance planning for next-generation systems and to administer a grant program.[96] ICO is to provide matching grants to eligible state or local governments or tribal organizations for the implementation, operation, and migration of various types of 911 and IP-enabled emergency services, and for public safety personnel training.[97] States that have diverted fees collected for 911 services are not eligible for grants under the program.[98] Based on the act's prioritized plan for funding programs with spectrum license auction revenue, the funds for the grant program will be made available only after $27.635 billion of available auction revenue has been applied to other purposes.

Provisions in the act regarding 911 programs include

- The GAO is required to study how states assess fees on 911 services and how those fees are used.[99]

[96] P.L. 112-96, Section 6503, "Section 158 "(a).

[97] P.L. 112-96, Section 6503, "Section 158 "(b).

[98] P.L. 112-96, Section 6503, "Section 158 "(c).

[99] P.L. 112-96, Section 6505.

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- The General Services Administration is required to prepare a report on 911 capabilities of multi-line telephone systems in federal facilities and the FCC is to seek comment on the feasibility of improving 911 identification for calls placed through multi-line telephone systems.[100]
- The FCC is to assess the legal and regulatory environment for development of NG9-1-1 and barriers to that development, including state regulatory roadblocks.[101] The FCC is also to (1) initiate a proceeding to create a specialized Do-Not-Call registry for public safety answering points, and (2) to establish penalties and fines for autodialing (robocalls) and related violations.[102]
- ICO, in consultation with NHTSA and DHS is to report on costs for requirements and specifications of NG9-1-1 services, including an analysis of costs, and assessments and analyses of technical uses.[103]
- Immunity and liability protections are provided—to the extent consistent with specified provisions of the Wireless Communications and Public Safety Act of 1999—for various users and providers of Next Generation 911 and related services, including for the release of subscriber information.[104]

The act also requires FirstNet to promote integration of the nationwide public safety broadband network with PSAPs.[105] Since the NTIA has responsibilities for both ICO and FirstNet, the agency is in a position to encourage interoperability between PSAPs and First Responders as they move to common IP-based platforms.

Technology and Standards

Standardization of network components, including radios, is generally considered essential to achieving interoperability, improving service, and reducing operating costs. Technical requirements for FirstNet are to be based on commercial standards for LTE.[106] The commercial sector has begun the transition to operating on IP-enabled networks such as LTE. Wireless carriers around the world are installing LTE networks for consumers and planning for the next generation of LTE: LTE Advanced.[107] LTE Advanced technologies will be able to operate across noncontiguous spectrum bands, thereby increasing channel widths for greater capacity and performance. Most experts agree that LTE Advanced will facilitate the transition to new technologies by making it easier and less expensive to phase out older infrastructure.

To expedite the expansion of LTE, commercial carriers have often relied on Wide Area Network (WAN) installations and configurations of small cells to create what are commonly referred to as

[100] P.L. 112-96, Section 6504.

[101] P.L. 112-96, Section 6509.

[102] P.L. 112-96, Section 6507.

[103] P.L. 112-96, Section 6508.

[104] P.L. 112-96, Section 6506.

[105] P.L. 112-96, Section 6206 (b) (2) (C).

[106] P.L. 112-96, Section 6203 (c) (2).

[107] Also known as 3GPP Release 10, see http://www.3gpp.org/LTE-Advanced.

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micro networks. The micro networks operate on standards for LTE and IEEE (Institute of Electrical and Electronics Engineers) 802.11 for WiFi. Micro networks may become a key component of FirstNet, as they represent an opportunity to add capacity at a local level in times of emergency.

FirstNet

The Spectrum Act requires FirstNet to assure nationwide standards for use of and access to the network it is tasked with developing. The act specifies the use of commercial standards for some of the network components.[108]

To promote competition, devices for public safety network radios and other wireless devices are required to be built to open, non-proprietary, commercially available standards, "capable of being used by any public safety entity and by multiple vendors across all broadband networks operating in the 700 MHz band" and backward compatible with existing commercial networks where necessary and reasonable.[109]

FCC

The act required the FCC to establish a Technical Advisory Board for First Responder Interoperability, and set out criteria for the selection and participation of board members.[110] The primary purpose of the board was to agree on minimum technical requirements for nationwide interoperability on the public safety broadband network. The Interoperability Board was required to develop these technical recommendations in consultation with the NTIA, NIST, and the OEC.[111] The board's technical recommendations were required to be based on commercial standards for LTE.[112] The establishment of minimum technical requirements has a two-fold purpose. One, the requirements are to be presented to the Board of Directors of FirstNet as recommended requirements for interoperability.[113] Two, the minimum technical requirements are to be used by the FCC as a standard of interoperability for evaluating state plans in cases where states have asked to build their own radio access networks.[114]

In the report it submitted,[115] the Interoperability Board, in addition to minimum technical standards, also provided additional considerations that it judged to be important for achieving interoperability.

[108] P.L. 112-96, Section 6202 (b).

[109] P.L. 112-96, Section 6206 (b) (2) (B).

[110] P.L. 112-96, Section 6203.

[111] P.L. 112-96, Section 6203 (c) (1).

[112] P.L. 112-96, Section 6203 (c) (2).

[113] P.L. 112-96, Section 6203 (c) (3).

[114] P.L. 112-96, Section 6302 (e) (3) (C).

[115] *Recommended Minimum Technical Requirements to Ensure Nationwide Interoperability for the Nationwide Public Safety Broadband Network*, prepared by the Technical Advisory Board for First Responder Interoperability, Final Report, May 22, 2012, at http://www.fcc.gov/document/recommendations-interoperability-board.

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NIST

The Director of NIST, in consultation with the FCC, DHS, and the National Institute of Justice, Department of Justice, is to "conduct research and assist with the development of standards, technologies and applications to advance wireless public safety communications."[116] More specifically, in consultation with FirstNet and the Public Safety Advisory Committee, NIST is to

- Document technical requirements for public safety wireless communications.
- Accelerate the development of interoperability between currently deployed systems and the public safety broadband network.
- Establish a research plan and direct research for next-generation wireless public safety needs.
- Accelerate the development of broadband network features such as mission-critical voice, prioritization, and authentication.
- Accelerate the development of communications equipment and technology to facilitate the eventual migration of public safety narrowband communications to the public safety broadband network.[117]

Furthermore, the Director of NIST, in consultation with FirstNet and the FCC, "shall ensure the development of a list of certified devices and components meeting appropriate protocols and standards for public safety and commercial vendors."[118]

Need for Standards Development

Narrowband and broadband networks for public safety will by most accounts be incompatible with each other and with other networks for the foreseeable future.[119] Only a small part of the existing public safety infrastructure is expected to be usable in the development of new networks at 700 MHz. To maximize the utility of new investments in infrastructure and radios, many believe that standards that support public safety applications for IP-enabled technologies must be completed in the early stages of planning and building. Just as access to the Internet has revolutionized business and social cultures worldwide, the transition to IP-enabled networks is likely to expand the capability and scope of emergency communications.

The act variously requires NIST, the FCC, and the NTIA[120] to develop standards and take steps to improve spectrum efficiency and support the development of the next generation of wireless technology. These agencies already have a number of initiatives in place, notably the Public Safety Communications Research program (PSCR). PSCR provides research, development, and testing to advance public safety communications interoperability. The program is a joint effort

[116] P.L. 112-96, Section 6303 (a).

[117] P.L. 112-96, Section 6303 (b) (1 – 5).

[118] P.L. 112-96, Section 6206 (c) (6).

[119] Discussed in GAO report, *Emergency Communications: Various Challenges Likely to Slow Implementation of a Public Safety Broadband Network*, February 2012, GAO-12-343.

[120] In addition to assigning NTIA responsibilities to develop public safety broadband communications, the act also specifies the NTIA's responsibility to promote efficient use of spectrum by the federal government. P.L. 112-96, Section 6410.

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between NIST's Office of Law Enforcement Standards and NTIA's Institute for Telecommunication Sciences and is sponsored by the Office for Interoperability and Compatibility at DHS, and the Department of Justice Community Oriented Policing Services.[121]

The funding for the federal research and development efforts described in the act is provided from spectrum license auction revenue. The timing of the auctions and the prioritization for distributing auction revenues are such that the funds designated for research and development may not be available for several years, if at all. Some of the act's provisions require the FCC to auction designated spectrum within three years.[122] The first of these auctions, Auction 96, was completed on February 27, 2014, with a total winning bid of $1.564 billion.[123] The first round of funding for NIST ($100 million) would occur once the proceeds from spectrum license auctions deposited in the Public Safety Trust Fund surpass $7.135 billion. The second funding round for NIST would occur after deposits reach $27.75 billion. Although resources in existing federal programs may be shifted to give priority to the implementation of the Middle Class Tax Relief and Job Creation Act of 2012,[124] the federal government may not be able to fund all of the standards and other technological research that is required by the act or needed for public safety. Timely development of public safety applications and standards may come primarily from the private sector, where some vendors are developing components needed for the broadband network and its devices. To meet its responsibilities under the act, FirstNet may choose to allocate some of the funding provided to it by the act, or raise additional funds, to facilitate standards development.

If no solution is found to coordinate private and public work on standards development and new technologies for emergency communications, the development of IP-enabled technologies for public safety may continue to lag behind that of the commercial sector, perpetuating the high costs and inefficiencies that have plagued first responder communications for decades.

Roaming and Priority Access Within the 700 MHz Band

In its *National Broadband Plan*, the FCC indicated that it wanted to make commercial networks in the 700 MHz band available for public safety use and requested that Congress confirm the FCC's authority to act.[125] The Spectrum Act provides the FCC with statutory authority to

[121] More information is available at the PSCR website at http://www.ntia.doc.gov/category/public-safety. PSCR activities were discussed in testimony by Mary H. Saunders, Director, Standards Coordination Office, NIST before the House Committee on Homeland Security, Subcommittees on Emergency Preparedness, Response, and Communications and Cybersecurity, Infrastructure Protection, and Security Technologies, "First Responder Technologies: Ensuring a Prioritized Approach for Homeland Security Research and Development," May 9, 2012.

[122] P.L. 112-96, Section 6401 (b).

[123] FCC Public Notice, "Winning Bidder Announced for Auction 96," DA 14-279, February 28, 2014, http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0228/DA-14-279A1.pdf.

[124] The PSCR, for example, has changed its plans for testing public safety interoperability in response to provisions in the act, http://www.pscr.gov/about_pscr/press/broadband/pscr_to_focus_on_public-safety_broadband_interoperability_tests_042012-mission_critical.pdf.

[125] FCC, *Connecting America: The National Broadband Plan*, http://www.broadband.gov/download-plan/.

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establish rules in the public interest to improve the ability of public safety networks to roam on commercial space and to gain priority access.[126]

FirstNet is empowered by the act to enter into agreements with commercial providers that would allow public safety network users to roam on partnering networks.[127] The act does not state whether roaming agreements may be negotiated by states that opt-out and receive spectrum leases from the NTIA to operate their own radio access networks. Agreements might also cover rules for priority access in times of high demand for network capacity. Priority access can take several forms, such as "ruthless pre-emption," in which non-public-safety transmissions are immediately terminated to make way for emergency communications, or negotiated priority agreements that might, for example, place public safety users at the head of the line for network access as capacity becomes available. The act stipulates that the FCC's authority may not require roaming or priority access unless (1) the public safety and commercial networks are technically compatible; (2) the commercial network is reasonably compensated; and (3) access does not preempt or otherwise terminate or degrade existing traffic on the commercial network.[128] Within these limits, the FCC appears to have some leeway to use its regulatory authority to support public safety in negotiations with partners. The FCC cannot, under the act, mandate ruthless pre-emption, although the act does not preclude contractual negotiations that would allow it.

The act's provisions for roaming and priority access do not require a commercial vendor to make additional investments to insure technical compatibility, and the act's language might be interpreted as precluding an FCC mandate to that effect. Interpretation and enforcement of the compatibility provision may pose an obstacle to achieving desired levels of network interoperability and cross-network roaming because existing technical standards for the 700 MHz band might preclude affordable full-spectrum roaming, that is, the ability of any network within the 700 MHz to roam on any other network within the 700 MHz band. Full-spectrum roaming is considered by many to provide advantages for public safety and also for the public at large. For example, it makes more network capacity available for shared emergency communications of all types, not just for first responders. Many believe that full-spectrum access supports competitiveness among wireless carriers—in particular assisting small wireless carriers serving rural areas to offer new broadband services—by providing access to all customers within the band.

Achieving full-spectrum roaming on the 700 MHz band requires modifications of technical requirements for LTE, the preferred technology for mobile broadband within the 700 MHz band. The FCC has taken actions in support of full-spectrum roaming ,[129] including steps to implement a voluntary industry agreement to establish interoperability for LTE in the lower 700 MHz band.[130] Establishing additional standards to enable full-spectrum interoperability will permit interoperability among all commercial carriers and public safety agencies.

[126] P.L. 112-96, Section 6211.

[127] P.L. 112-95, Section 6206 (c) (5).

[128] P.L. 112-96 Section 6211.

[129] FCC, "Promoting Interoperability in the 700 MHZ Commercial Spectrum," Notice of Proposed Rulemaking, WT Docket No. 12-69, released March 21, 2012.

[130] FCC, "Report and Order and Order of Proposed Modification," WT Docket No. 12-69, released October 29, 2013.

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FirstNet Status Report for 2013

The Chairman of FirstNet, Samuel Ginn, provided testimony on FirstNet's progress at a hearing on November 21, 2013.[131] Mr. Ginn prefaced his testimony with a strong statement that FirstNet holds full responsibility for its own success. He went on to describe the efforts of the board members who did double duty to compensate for the delayed hiring of key employees. Senior management positions that were filled beginning in spring 2013 include a General Manager, Deputy General Manager, Chief Financial Officer, Chief Counsel, Chief of Staff, and Chief Administrative Officer. During the interim period, the board focused, in particular, on outreach to states, negotiations with BTOP grant recipients, and development of policies and practices for self-governance. These activities continue and expand as new staff are brought on board.

In June 2013, Requests for Information regarding separate aspects of FirstNet technical requirements and strategies for implementation were issued. The information provided by the 285 responses is providing a resource for developing partnerships and preparing the Requests for Proposals that will lead to the building of FirstNet.

Mr. Ginn provided Congress with a list of FirstNet's priorities for FY2014. These were described as:

- Network Partnerships. Explore and validate a wide variety of partnership opportunities.
- Requests for Information. Evaluate the responses to 10 RFIs that covered topics in two main categories: Radio Access Networks, which includes network partnering and providers, antenna systems, microwave backhaul equipment, mobile network solutions, satellites; and Core Network, which includes enhanced packet core, transmission/transport, data center, network management center/operations management center, network service platforms.
- Core Network. Assure that the core network meets high standards for security, operations, and business support.
- State Consultation and Plans. Identify full service and support opportunities, device procurement, and network service fees. Explain the role of FirstNet and its responsibilities to each state.
- Integration of BTOP Projects. Leverage BTOP's public safety grant programs to establish market-based deployments of the nationwide network that will demonstrate its benefits and capabilities to public safety jurisdictions across the country.
- Mobile Network Solutions. Evaluate and plan for deployable network infrastructure to supplement or replace fixed infrastructure such as cell towers. Explore the potential of a variety of deployable infrastructure technologies, that might include satellite, microwave, balloons, and Unmanned Aerial Vehicles (drones).

[131] Hearing, House Committee on Energy and Commerce, Subcommittee on Communications and Technology, "Oversight of FirstNet and the Advancement of Public Safety Wireless Communications," testimony of Samuel Ginn, November 21, 2013.

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- Wireless Devices. Assure that public safety agencies will have a portfolio of broadband LTE devices, built to open standards. Leverage FirstNet's national scale and open standards to significantly reduce device price points.

Mr. Ginn testified that the issue of controlling costs is a key factor in the success of the network. This means, for example, competitive pricing for FirstNet's services to states and tribal nations, low-cost mobile devices, and leveraging investments in infrastructure through partnerships.

Mr. Ginn stated that FirstNet's "objective is to develop long-standing relationships with public safety at every level." To support state local, and tribal emergency response and recovery communications needs, FirstNet plans to establish 10 regional offices that align with the regional offices of the Federal Emergency Management Agency.[132]

FirstNet engages with its federal partners through the Emergency Communications Preparedness Center[133] and individual agencies.

Considerations for Congress

Congress may wish to examine the environment in which FirstNet is operating to see if it can be improved to help assure FirstNet's success in the efficient establishment of a nationwide network, such as assuring continuity of operations, and establishing self-funding measures for investment and operations.

Evolving Network Technologies

In the two years since the Spectrum Act was passed, communications technologies have evolved in ways not fully anticipated at the time.[134] Advances in small cell technology, in particular, are moving traffic management away from the core of cell tower infrastructure and toward micro networks built on the principles of Wide Area Networks. These micro networks are local in nature but fully interoperable across wide geographic areas.

FirstNet's decision to create ten regional offices meets both governance needs and the likely organization of FirstNet's nationwide infrastructure. The regional structure takes advantage of new networking solutions that can build on existing deployments of broadband networks. Every firehouse, 911 call center, police station, and other public structure, including lampposts and traffic lights, might be a link in a micro network. In this environment, the integration of Next Generation 911 infrastructure with FirstNet becomes a crucial part of network deployment strategy.[135]

[132] Informations on FEMA's Regional Centers at http://www.fema.gov/regional-operations.

[133] Information at https://www.dhs.gov/emergency-communications-preparedness-center.

[134] 4G Americas, *Meeting the 100X Challenge: The Need for Spectrum, Technology and Policy Innovation,* October 2013, http://www.4gamericas.org/documents/2013_4G%20Americas%20Meeting%20the%201000x%20Challenge%2010%204%2013_FINAL.pdf.

[135] Hearing, House Committee on Energy and Commerce, Subcommittee on Communications and Technology, "Oversight of FirstNet and the Advancement of Public Safety Wireless Communications," testimony of Samuel Ginn, November 21, 2013.

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Governance

Congress may also wish to address concerns about who is responsible for deploying the broadband network. Some of the reported confusion among potential partners about FirstNet's plans for the future[136] may stem from the different positions about network development taken by FirstNet's management and the NTIA. Both have expressed views about the nature of FirstNet, with the NTIA favoring centralized control of the network, led by the Department of Commerce, and FirstNet moving toward a network structure that treats states as equal partners.

In helping to stand up FirstNet, NTIA administrators have, apparently, chosen to treat FirstNet as if it were to exist within the Department of Commerce in perpetuity.[137] Treating FirstNet as a division of the Department of Commerce might be described as setting a course for FirstNet to become "another Amtrak," a term used by many, within and outside Congress,[138] to denote over-dependence on federal subsidies, as in the case of financial support for Amtrak.[139] However, the governance structure of Amtrak is not the source of Amtrak's financial woes. Most policy makers believe that weak consumer demand and market regulations have contributed to Amtrak's failure to be a profitable corporation, even though it was intended as such at the time of its formation.

Amtrak

Amtrak, originally known as the National Railroad Passenger Corporation (NRPC), was created by the Rail Passenger Service Act of 1970 (P.L. 91-518). The purpose of the act was "to provide financial assistance for, and establishment of, a national rail passenger system, to provide for the modernization of railroad passenger equipment ..." and related purposes,[140] in response to a perceived "threat that railroad passenger service might disappear throughout the country."[141]

The NRPC was established by Congress as a private, for-profit corporation, not as an entity of the federal government. Nonetheless, eight of the 15 members of the board of directors were to be appointed by the president, with the remainder chosen to represent shareholders. The corporation was required to issue both common and preferred stock. A 15-member advisory panel was established to advise the board on ways to increase capitalization. The NRPC received a combination of direct appropriations and loan guarantees, including direct loans or guarantees to railroads entering into contracts with the NRPC, in order to be relieved of their obligations to provide passenger service. Subsequent legislation – in 1972, 1973, 1974, and 1975 – created a

[136] Hearing, House Committee on Energy and Commerce, Subcommittee on Communications and Technology, "Oversight of FirstNet and the Advancement of Public Safety Wireless Communications," Opening Statement of Chairman Walden, November 21, 2013.

[137] In a meeting with CRS on January 29, 2014, NTIA officials noted that FirstNet is within the Department of Commerce, justifying steps such as the inclusion of "Department of Commerce" with the FirstNet logo, and repeatedly asserted that NTIA was in charge of FirstNet because it was the NTIA that would be held responsible by Congress for FirstNet's success or failure. The NTIA has created an Office of Public Safety Communications specifically to administer the public safety responsibilities outlined to the NTIA in the act, including the administration of grants, among other responsibilities.

[138] The term has been used, for example, by Rear Admiral (ret.) Jamie Barnett, former head of the FCC's Public Safety and Homeland Security Bureau, in discussions of FirstNet.

[139] See CRS Report R42889, *Issues in the Reauthorization of Amtrak*, by David Randall Peterman and John Frittelli.

[140] CRS Report 70-299 E, *The Rail Passenger Service Act of 1970: Public Law 91-518*, by Thomas E. McCardell, December 1, 1970. Available upon request from the author of this report.

[141] Ibid.

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form of public service corporation whose primary objective is to serve the public convenience and necessity.[142]

Conrail

To address continuing problems in the railroad industry, the Regional Rail Reorganization Act of 1973 (P.L. 93-236) created the Consolidated Rail Corporation (Conrail) as a for-profit corporation. Conrail was authorized and directed by Congress, in brief:[143]

- To acquire rail properties.
- To operate rail service.
- To rehabilitate and improve rail properties.
- To maintain adequate and efficient rail service.

To capitalize the business, Conrail was authorized to issue common stock, among other provisions in the act that addressed financing. As long as 50% or more of Conrail's debt was owed to or backed by the federal government, it was obliged to maintain federal representation on its board and was subject to the Government Corporation Control Act for auditing purposes. Beginning in 1987, Conrail sold its assets to the private sector, with the proceeds going to the Treasury. The private sector also acquired Conrail's public obligations as a common carrier.

Although there are some differences between the governance structures, Conrail succeeded where Amtrak struggled in large part due to growing demand for freight traffic contrasted with diminishing demand for passenger rail service.

FirstNet

Although public safety communications are considered essential, as was rail passenger service when the NRPC was created, the wireless communications industry is vibrant and growing, whereas the railroad industry was in a chaotic state after the bankruptcy of the Penn Central Railroad.

To fund its operations, FirstNet is encouraged by the act to create public-private partnerships. The language of the Spectrum Act appears to have given FirstNet a mandate to have established itself as an ongoing, self-funding organization by 2022. These provisions, among others, suggest that Congress was seeking to establish an entity that might be more like Conrail than Amtrak. Absent specific instructions, stakeholders would appear to have some influence in deciding whether FirstNet—a unique hybrid—will be closer to being an Amtrak or a Conrail.

The act's provisions regarding FirstNet's operations are consistent with Congress's decision to provide a goal—the creation of a new communications network service for public safety—and set a deadline for the achievement of the goal. To achieve this goal, FirstNet might benefit from the

[142] Arnold Adams, "The National Railroad Passenger Corporation—A Modern Hybrid Corporation Neither Private nor Public," *The Business Lawyer*, Vol. 31, January 1976.

[143] Regional Rail Reorganization Act of 1973, House of Representatives Conference Report, No. 93-744, December 20, 1973.

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maximum leeway in its operations, consistent with twin mandates for inclusive governance (such as states and public safety agencies at all levels) and private sector partnerships that invest in the network by making available infrastructure and other capital investments.

Assessment by the GAO

Before the end of FY2022, GAO is to recommend to Congress what actions should be taken in regard to the end of FirstNet's authority, which the act mandated to occur in 2027, 15 years after the passage of the act.

Options for GAO recommendations regarding governance may include:

- Federal corporation with the authority to issue bonds not backed by the federal government, and that, in time, becomes self-sustaining; the Tennessee Valley Authority (TVA) might provide an example of how such a charter might evolve.[144]
- Hybrid corporation established by the federal government, relying on a combination of earned income and federal funding, such as Amtrak.
- Corporation established by the federal government, such as Conrail. The federal presence on the Conrail board was tied to repayment of federal obligations.
- Federal corporation established as a transition vehicle to transfer to the private sector, such as the U.S. Enrichment Corporation.
- Federal agency in perpetuity either as an entity within the NTIA or through some other federal governance structure.

These potential choices will likely be influenced by decisions made by FirstNet's board and management team, and by the NTIA through the grant process and the policies it establishes.

In its oversight of FirstNet, Congress may wish to consider the impact of decisions made today on the probable future outcome for FirstNet. Business organization and technology choices are often closely linked; businesses that revise their management and production structures to incorporate new technology tend to be more productive.[145] Therefore, governance choices for FirstNet may help the authority to be more efficient and effective if they fully accommodate new technologies. An example is the announcement by AT&T of plans that are predicted to "transform the wide area network" and reduce capital expenditures.[146]

In light of what is likely to become a significant shift in wireless network technology, a preliminary analysis of FirstNet by the GAO might lead to recommendations for how to mesh current business plans for the new network with a transition strategy for possible future governance structures.

[144] The Administrative Budget for FY2014 proposed privatizing the TVA and required the Office of Management and Budget to perform a strategic review.

[145] *The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies*, by Erik Byrnjolfsson and Andrew McAfee, W.W. Norton and Company Ltd., January 20, 2014.

[146] Paul Taylor, "AT&T Shifts to 'Virtualised' Hardware," *Financial Times*, February 26, 2014.

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