

Public Safety Communications and Spectrum Resources: Policy Issues for Congress

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Summary

Effective emergency response is dependent on wireless communications. To minimize communications failures during and after a crisis requires ongoing improvements in emergency communications capacity and capability. The availability of radio frequency spectrum is considered essential to developing a modern, interoperable communications network for public safety. Equally critical is building the radio network to use this spectrum. Opinions diverge, however, on such issues as how much spectrum should be made available for the network, who should own it, who should build it, who should operate it, who should be allowed to use it, and how it might be paid for. As a consequence, nascent planning for a national network is incomplete and some state and local network plans have been delayed.

To resolve the debate and move the planning process forward, Congress may decide to pursue oversight or change existing law. Actions proposed to Congress include (1) authorizing the Federal Communications Commission (FCC) to reassign spectrum and (2) changing requirements for the use of spectrum auction proceeds. In particular, legislation in the Deficit Reduction Act of 2005 (P.L. 109-171), as amended, might be modified. This law mandated the termination of analog television broadcasting and the release of those channels for other uses, including public safety. The act identified the frequencies from the analog television channels that were to be auctioned by the FCC. It also created a trust fund that set aside part of the auction proceeds for a number of programs, with the balance destined for the U.S. Treasury. Among the programs receiving funds from the trust fund was a billion-dollar program for grants to public safety, the Public Safety Interoperable Communications (PSIC) grant program. Under the law, states have until FY2010 to draw down these funds. Bills that would extend the deadline to the end of FY2012 have been introduced in the House and Senate.

Alternative proposals on how to assign spectrum for public safety use have been presented to the FCC and to Congress. To build the needed network requires coordination at many levels: developing the network concept, identifying a governance structure that assures the network is built and maintained, and funding capital and operating costs. Many believe that empowering leadership and identifying funding sources should ideally be resolved before the final decision is reached about spectrum allocation.

There is an opportunity for two transformative changes in policy: for public safety communications and for spectrum management. As old technologies give way to mobile Internet access, changes in spectrum management are required to accommodate new wireless technologies. For the public safety community to incorporate these new technologies into emergency communications would require a change in stakeholders' planning goals. The interaction between spectrum policy and homeland security policy might be changed through the planning and execution of an interoperable network for public safety. Congress has recognized the value of using Internet protocols for IP-based networks for 911 communications, by supporting the transition of out-dated 911 systems to IP-based technologies. Congress has not previously considered giving the same attention to the adoption of IP-based technologies for public safety radio communications. Congress might provide leadership and resources that can bring a nationwide, interoperable network for public safety from concept to reality.

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The Issues Before Congress

Since September 11, 2001, Congress has passed several significant pieces of legislation intended to help surmount failures in public safety radio communications such as (1) insufficient interoperability among radio systems, a problem that hampered rescue efforts on and after September 11; and (2) insufficiently robust networks, a shortcoming revealed after Hurricane Katrina struck in August 2005. Congress may decide that oversight or additional legislation is needed in order to meet desired levels of emergency communications performance. To meet these goals would require, among other elements, improvements in communications capacity and quality, which in turn would require both new investments in communications infrastructure and additional radio frequency spectrum capacity.

Spectrum Resources

Congress addressed the public safety community's need for spectrum by mandating, in 2005, the release of 24 MHz[1] of frequencies that were originally designated for public safety use in the late 1990s.[2] This crucial resource, part of the 700 MHz band, remained largely unavailable as long as its airwaves were used for analog television transmissions. By providing a deadline for the transition from analog to digital television, Congress ensured that valuable radio frequency spectrum would be released by 2009.[3] Although the transition to digital television has cleared the frequencies assigned to public safety, only a small part of this resource has been put into service. Much of the congressionally mandated allocation lies fallow while policy makers weigh how best to maximize the value of the spectrum—for public safety and for the public interest.

Communications Infrastructure

Wireless communications over unseen airwaves are possible because of the application of technology. In simplified terms, wireless communications infrastructure is the combination of

- Hardware (such as cell towers and radios).
- Software that provides operating and administrative systems.
- Managerial decisions such as how to supervise traffic volumes and connections, control access, provide area coverage, and connect to other communications networks, servers, and data centers.

[1] 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. Public safety has frequency allocations within this band totaling 24 MHz.

[2] The Deficit Reduction Act of 2005, P.L. 109-171, Title III, Sec. 3002 120 STAT. 21 set a deadline for releasing the frequencies. Initial legislation requiring the release was in the Balanced Budget Act of 1997, P.L. 105-33, Title III, Sec. 3003 and Sec. 3004, 111 STAT. 265 *et seq*.

[3] Expediting the release of these frequencies was among the recommendations of the 9/11 Commission. *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States*, p. 397, Washington: GPO, 2004.

Backhaul, which typically refers to connectivity from access points like cell towers to high capacity, landline communications networks, is also an essential component of wireless network infrastructure. Infrastructure for vital services such as emergency communications requires additional measures to ensure operability in difficult environments such as extreme weather and power failures.

Public Safety Broadband Network Requirements

Developments in mobile broadband communications are changing the public safety community's expectations about how to best use the 700 MHz airwaves set aside for their use. Public safety representatives have argued that this spectrum should be used for a wireless network customized to meet needs that they have indentified. Some of the network infrastructure requirements most often discussed are[4]

- Broadband applications should facilitate emergency response by providing data and images, including video.[5]
- Cell towers in the network should be strengthened against natural hazards and furnished with back-up power supplies that can outlast extended power outages.
- The network should cover all areas of the United States, ensuring service to meet a public safety emergency anywhere.
- Broadband services should include voice communications as a back up to mission critical voice channels on other frequencies and offer the same features such as push-to-talk and one-to-one or one-to-many connectivity.
- Network software should provide traffic management services such as prioritizing service. If multiple networks were built separately and then linked together, interoperability[6] and nationwide roaming[7] would need to be ensured.
- Radio software should provide mobile broadband applications designed for public safety. In particular, radio chipsets need to be developed for wireless devices that can connect to a Long Term Evolution (LTE) network.
- Radio software should support encryption and authentication.

[4] These requirements are included in presentations by Ralph A. Haller, Chairman of the National Public Safety Telecommunications Council, and Chief Harlin R. McEwen, Chairman of the Public Safety Spectrum Trust, at an FCC National Broadband Plan Staff Workshop on August 25, 2009. The presentations are available at http://www.npstc.org/index.jsp.

[5] Broadband refers to the capacity of the radio frequency channel. A broadband channel can transmit live video, complex graphics and other data-rich information as well as voice and text messages whereas a narrowband channel might be limited to handling voice, text, and some graphics.

[6] One frequently cited definition of interoperability has been provided by the government agency SAFECOM: "In general, interoperability refers to the ability of public safety emergency responders to work seamlessly with other systems or products without any special effort. Wireless communications interoperability specifically refers to the ability of public safety officials to share information via voice and data signals on demand, in real time, when needed, and as authorized." http://www.safecomprogram.gov.

[7] The practice of transferring a wireless call from one network to another—or roaming—is described in *Understanding Wireless Telephone Coverage Areas,* FCC Consumer Facts at http://www.ifap.ru/library/book385.pdf.

Arguments in favor of building a network exclusively for public safety revolve around the shortcomings of current commercial wireless services such as poor availability, inadequate coverage in rural areas, lack of security features, and absence of priority access.[8] Others believe that the needed services can be better provided through a commercial network or some form of partnership that would share public and private resources.[9] Among the unresolved questions is whether the network would be owned by its builders, by its license-holders, or through joint agreement. Planning efforts have so far failed to provide a solution for developing network infrastructure that satisfies the demands of public safety, meets federal policy goals for spectrum use and homeland security, and conforms to existing legislation.

Federal Communications Commission Planning Efforts

The Federal Communications Commission (FCC)[10] is the only federal agency to propose a national network for public safety communications infrastructure and to take action to plan, implement, and fund it. The FCC has proposed a public-private partnership to build a broadband network to benefit public safety. [11] Its proposal would incorporate obligations into auction rules for a commercial network operator that would provide for a shared, national network using public safety and commercial frequencies at 700 MHz. Planning for the network would be conducted on a nationwide basis. To create the partnership, the FCC provided for two national licenses of 10 MHz each. One license was assigned to a Public Safety Broadband Licensee (PSBL). The 10-MHz license held by the PSBL is part of the 24 MHz originally assigned to public safety. The other license—designated the Upper Block D, or D Block—was scheduled for auction in 2008 to a commercial provider. At the auction, the FCC's requirements could not be met by any bidder. The failure to find a commercial partner to work with the public safety license-holder has effectively reset the planning process to zero.[12] The FCC has decided to include an assessment of public safety broadband needs as part of its preparation of a national broadband plan, as required by the American Recovery and Reinvestment Act.[13] With a public notice released September 28, 2009,[14] the FCC sought information about current and potential future use of broadband in public safety communications. It asked for comment on how to meet requirements specified as essential to public safety communications, including cyber security. The notice also seeks comment on costs and networking solutions.

[8] See presentation of Chief McEwen, cited above.

[9] Comments endorsing the positions noted here are filed with the FCC under PS Docket No. 06-229.

[10] The FCC manages spectrum access for commercial and other non-federal uses. The National Telecommunications and Information Administration is responsible for overseeing spectrum used by federal agencies.

[11] FCC, *Second Report and Orde*r, July 31, 2007, WT Docket No. 96-86 and *Third Further Notice of Proposed Rulemaking*, released September 25, 2008, PS Docket No 06-229 at http://fjallfoss.fcc.gov/edocs_public/attachmatch/FCC-08-230A1.pdf. Additional comments have been sought through other mechanisms and the docket remains open.

[12] The history of the D Block is summarized in **Appendix B**. Spectrum Allocation and Assignment for Public Safety.

[13] P.L. 111-5, Division B, Title VI, Sec. 6001 (k) (1), 123 STAT. 515.

[14] FCC, NBP Public Notice # 8, *Additional Comment Sought on Public Safety, Homeland Security, and Cybersecurity Elements of National Broadband Plan*, DA 09-2133, released September 08, 2009, GN Docket Nos. 09-47, 09-51, 09-137 at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-2133A1.pdf.

National vs. State Planning

Some states and localities have petitioned the FCC to allow them to incorporate frequencies from the 10 MHz assigned to the PSBL into their own public safety networks.[15] Plans would be developed based on local and regional needs, with anticipated funding from sources such as existing programs, partnerships with commercial providers, and federal grants. The plans are being conceived without a framework for nationwide interoperability and mobile broadband. However, comments filed with the FCC have stated that independent networks would be interoperable with a national network.

Although the FCC has proposed rules for how interoperability and other public safety needs would be met through a public-private partnership, it has not ruled on specific measures that would assure interoperability among multiple public safety networks. The National Public Safety Telecommunications Council (NPSTC), a group consisting primarily of public safety associations,[16] therefore laid out some requirements for a national network at 700 MHz. NPSTC partnered with DHS and the National Institute of Standards and Technology to "develop recommendations on the minimum elements required for a National Interoperability Framework to help ensure interoperability across all systems deployed."[17] The DHS agency providing technical expertise was the Directorate of Science and Technology, Command, Control and Interoperability Division (CCI). The NPSTC 700 MHz Broadband Requirements Task Force provided recommendations on operations, technical requirements, and governance. Their recommendations were directed primarily toward facilitating the early construction of state and local networks in advance of a nationwide network. The recommendations were sent to the Public Safety Broadband Licensee chosen by the FCC to represent the public safety community's interests, the Public Safety Spectrum Trust (PSST).[18] The PSST, in turn, will forward the recommendations it approves to the FCC for consideration.[19]

Department of Homeland Security Planning Efforts

Many of the statutes passed since 2001 have provided guidelines and set performance goals for public safety communications while delegating decisions about implementation to federal agencies and state officials. Although Congress has appropriated money for public safety communications it has not directly addressed the question of investment in network infrastructure, leaving it largely to federal agencies to set priorities for how public safety grants can be used.[20] Most of the grant programs are now administered through the Department of

[15] Petitioners are listed in **Appendix C**. Requests to Build Regional Networks in Advance of the Assignment of the D Block.

[16] NPSTC has fifteen voting members and two non-voting members. Information about NPSTC can be found at http://www.npstc.org/npstcintro.jsp.

[17] NPSTC Press Release, "NPSTC to Develop Requirements for a 700 MHz Broadband Network," June 12, 2009 at http://www.npstc.org/documents/Press_Release_Task_Force_090612.pdf.

[18] A summary of the NPSTC recommendations appears in the "Providing Structure" section of this report under the title "Connected Networks."

[19] Testimony of Chief Harlin R. McEwen, Chairman, Public Safety Spectrum Trust at Hearing, House of Representatives, Committee on Energy and Commerce, Subcommittee on Communications, Technology, and the Internet, "A National, Interoperable Broadband Network for Public Safety: Recent Developments," September 24, 2009.

[20] Legislation and DHS activities are summarized in **Appendix A**. Congressional Efforts on Behalf of Public Safety Communications.

Homeland Security (DHS),[21] but the National Telecommunications and Information Administration (NTIA) also has been given responsibility for grants for public safety.[22] Grants for emergency communications have been used to purchase equipment that facilitates interoperability, for planning, and for training.

To facilitate planning and coordination, and to provide direction, Congress authorized the creation of an Office of Emergency Communications (OEC) within DHS. The OEC was given the responsibility of preparing a National Emergency Communications Plan (NECP). The resulting plan set goals for improving emergency communications and interoperability but did not address developing a network infrastructure for public safety communications or for using the 700 MHz spectrum for that purpose.[23]

To support its vision[24] of interoperability as a system of systems, DHS sponsored an Emergency Response Council (ERC) composed of several dozen agencies, associations, and other entities involved in public safety and emergency response planning. In 2007 the ERC provided a set of agreements on a Nationwide Plan for Interoperable Communications. The ERC published 12 guiding principles deemed essential to their key goals of forging partnerships, designing interoperable systems, educating policymakers, and allocating resources.[25] To date, the council's role has been primarily to establish a base for advocacy and communication among representatives of public safety agencies and associations.

Decisions Are Needed

To date, the FCC has assumed the authority to decide how the public safety broadband network will be constructed and managed by applying auction rules and other spectrum management tools at its disposal. Neither the FCC nor DHS has been able to bring together the necessary elements that might achieve the stated goal of a national network offering interoperable, broadband communications for emergency communications. Some of the solutions being proposed to the FCC for action might require legislation in order to be realized. Congress might also choose to address other unresolved issues such as organizational structure, planning authority, and funding.

[21] DHS grants programs are discussed in CRS Reports CRS Report R40632, *FY2010 Department of Homeland Security Assistance to States and Localities*, and CRS Report R40246, *Department of Homeland Security Assistance to States and Localities: A Summary and Issues for the 111th Congress*, both by Shawn Reese.

[22] The Deficit Reduction Act of 2005 created the Digital Television Transition and Public Safety Fund to receive auction proceeds from the sale of new licenses in the 700 MHz band, and directed the NTIA to oversee disbursements from the fund. The NTIA contracted with the Department of Homeland Security to manage the grant process for one of the programs designated by Congress as a recipient, the Public Safety Interoperable Communications (PSIC) grant program. See http://www.ntia.doc.gov/budget/2010/FY2010CongressionalBudgetJustification.pdf.

[23] DHS, National Emergency Communications Plan, July 2008 at http://www.dhs.gov/xlibrary/assets/national_emergency_communications_plan.pdf

[24] "Our vision was developed at the 2003 SAFECOM/AGILE Joint Program Planning Meeting in San Diego, CA.", Emergency Response Council, *Agreements on a Nationwide Plan for Interoperable Communications*, Summer 2007, footnote 1.

[25] *Op. cit., Agreements on a Nationwide Plan for Interoperable Communications.*

Proposals for Spectrum Assignment

As stated earlier, after the auction of the D Block failed in early 2008, the FCC issued a new request for comments on how to restructure the auction to provide a network that would meet public safety needs. This led to a host of new suggestions on how to use the spectrum. The FCC's choices, however, are constrained by provisions of the Deficit Reduction Act of 2005. Many of the options proposed to the FCC might therefore require Congress to amend the act or to introduce other enabling legislation.

Broadband Plans and the D Block

Comments filed with the FCC[26] have opened debates about alternative courses of action. Although there are a number of different proposals, each in some way addresses the question of whether it will be public safety representatives or commercial owners and network operators that control the decision-making process. The following is a summary of proposals under discussion and possible agency or legislative actions that might be needed to implement them.[27]

Auction the D Block to Commercial Interests

- Agree to new rules for a D Block auction that satisfy the key goals laid out by the FCC for a shared network that benefits both public safety users and commercial interests. The D Block could be auctioned as a single, national license or as many licenses assigned to specific geographic areas. The FCC has the authority to structure such an auction under the Communications Act of 1934, as amended, including the amendments provided by the Deficit Reduction Act of 2005.
- Auction the D Block without any obligations to share with public safety. Public safety agencies could eventually add broadband applications to communications systems built in the 24 MHz of frequencies originally assigned to them. The FCC has the authority to facilitate this decision.
- Auction the D Block without any obligations to share with public safety and "give" the auction proceeds to public safety, possibly by transferring it to an existing grants program. The grants program most frequently mentioned is the Public Safety Interoperable Communication (PSIC) grant program set up by a provision in the Deficit Reduction Act of 2005. Congress might choose to amend the provisions for grants in the Deficit Reduction Act of 2005 or it might choose to create new legislation specifically for the distribution of the D Block auction proceeds. In either case, the cost of new authorizations would be scored by the Congressional Budget Office. Except where Congress has provided for exceptions, the Communications Act of 1934 states that, as a general rule, auction proceeds are deposited in the U.S. Treasury.[28]

[26] PS Docket No. 06-229.

[27] Proposals for building a new network and assigning spectrum were the topic of a House of Representatives hearing held by the Committee on Energy and Commerce, Subcommittee on Communications, Technology, and the Internet, "A National, Interoperable Broadband Network for Public Safety: Recent Developments," September 24, 2009.

[28] 47 U.S.C. 309 (j) (8) (A).

- Combine the 10-MHz D Block with the 10-MHz Public Safety Broadband License and auction the newly created 20-MHz block, with sharing requirements similar to some of those considered by the FCC for the D Block auction. Funds from the auction proceeds would go to public safety through a program established for that purpose. In addition to legislation that would establish the funding program, Congress might amend language in the Balanced Budget Act of 1997 that directed the FCC to assign 24 MHz from the 700 MHz band to public safety.[29]

Assign the D Block to Public Safety Licensees

- Assign the D Block to state, local, or regional network managers. These would negotiate with commercial partners on how to build, operate, and fund a shared network. This action would require agreement among the participants on how to assure nationwide interoperability of the separate networks. Because the Deficit Reduction Act of 2005 included the D Block frequencies among those that the FCC was required to auction, it appears that Congress might amend the law in order for this particular option to be exercised.
- Concurrent with the decision to assign the D Block to specific geographic areas, the Public Safety Broadband Licensee would provide matching sub-licenses for its spectrum holdings in those areas.
- Concurrent with the decision to assign the D Block to specific geographic areas, the role of the Public Safety Broadband Licensee would be eliminated or reduced by re-assigning geographic licenses from it to individual groups.

Other options may be proposed to or developed by the FCC.

Narrowband Radio Plans

Although the fate of the D Block looms large as a policy concern, related decisions about the use of the 700 MHz band have created dilemmas for some pre-existing network plans. Congress could choose to address obstacles that are preventing the completion of some plans for narrowband systems that use 12 MHz of the public safety frequencies at 700 MHz.[30] Voice, short message service (SMS), and similar transmissions do not make heavy demands on bandwidth. These applications operate efficiently on channels with limited capability to move data at high speed. These low-capacity channels are referred to as narrowband. Higher levels of service with fast, content-rich transmission require broader channels, or broadband. The original band plan for public safety was designed primarily for voice communications and the 24 MHz allocated to public safety was originally assigned in accordance with that plan.

[29] In the Balanced Budget Act of 1997 (P.L. 105-33) Congress defined public safety services as "services—(A) the sole or principal purpose of which is to protect the safety of life, health or property; (B) that are provided (i) by State or local government entities; or (ii) by nongovernmental organizations that are authorized by a governmental entity whose primary mission is the provision of such services; and (C) that are not made commercially available to the public by the provider." [47 U.S.C. § 337 (f)(1)].

[30] Of the 24 MHz allocated to public safety, 12 MHz is now designated for narrowband, 10 MHz is designated for part of a broadband network, and 2 MHz are designated as guard bands, intended to prevent interference from adjacent channels.

To provide the 10 MHz license for the Public Safety Broadband Licensee to match with the commercial license for the 10 MHz D Block, the FCC revised the original public safety band plan to create two different licensing plans for two separate network designs. The new band plan reassigned 12 MHz for a narrowband network; some frequencies were scheduled to be cleared to make room for the new broadband network.

Equipment for some of the narrowband networks must be modified to accommodate the new band plan.[31] FCC auction plans called for some of the costs of modification to be reimbursed by the winner of the D Block license.[32] No alternative source of funds to pay for the costs of relocation was identified by the FCC. Some plans for networks that included the affected frequencies have been put on hold, with some network operators voicing concern to the FCC that they would be obliged to pay for the changes.

The FCC has proposed that up to $27 million of costs be reimbursed by the D Block partner or partners.[33] Congress may consider authorizing funds for the rebanding programs to move forward, relieving state and local agencies from the burdens of uncertainty and unplanned expenditures.

FCC Policy Objectives

The demand for spectrum capacity among first responders and other emergency workers is variable. When radio communications are routine, demand for radio frequencies for emergency communications is modest. In times of crisis, demand for spectrum capacity exceeds availability. Identifying radio frequencies that public safety responders can share is a strategy for using valuable spectrum more efficiently. The policy pursued by the FCC in deciding to create the D block was to provide the basis for a public-private partnership that would manage shared resources, including spectrum. In normal times, access to the public safety spectrum would bolster the capacity of commercial networks; in times of crisis, extra channels would be opened for emergency communications.

The failure to auction the D Block has brought into question many of the key goals that the FCC had hoped to achieve, such as

- Coequal sharing; although sharing spectrum resources is not unusual in the wireless world, it is usually achieved through agreements between the owner of a spectrum license or network and a secondary user.[34]
- Private sector funding to help pay for public safety needs, with access to public safety frequencies intended as compensation for the additional capital investment.

[31] Over 40 different public safety agencies with significant deployments of 700 MHz infrastructure have filed relocation requests with the FCC, certifying their requirements for assistance, at PS Docket No. 06-229.

[32] *Second Report and Order*, paragraph 322.

[33] *Third Report and Order*, paragraph 14 and Appendix D, page 188.

[34] In addition, FCC regulations specifically prohibit sharing frequencies assigned to public safety with any party other than another public safety entity, with the current exception of the frequencies assigned to the Public Safety Broadband Licensee.

- Increasing the amount of spectrum available to public safety agencies to ensure sufficient bandwidth for a broadband network.
- Providing a competitive environment and economies of scale for the dissemination of broadband technologies among first responders by involving a commercial partner.

Three spectrum band plans were created at 700 MHz to support the FCC's goals for public safety: the D Block, now designated for commercial use; the Public Safety Broadband License, now assigned to a single licensee created to conform to FCC requirements; and the revised narrowband plan, administered by state and local entities under the direction of the FCC.

Providing Structure

Congress has been called upon by public safety groups, wireless industry corporations, and others to change the rules for spectrum assignment in the 700 MHz band.[35] Despite the sense of urgency to reach a decision, the many elements that need to be resolved would seem to argue for careful and deliberate review. A final decision about radio frequency assignment would be only one of many critical decisions for providing a broadband network for public safety purposes. Possession of the spectrum license brings with it obligations to pay for infrastructure. Congress might therefore consider other steps that would need to be taken and that might best be resolved at the outset. This section explores three decision sets that are among the fundamental issues that must be addressed: funding, governance, and concept.

Congress may wish to address the question of funding the new network before considering how it would be designed, built, and administered. A number of federal and state sources of revenue have been suggested by those public safety and industry officials, and others, who argue for ownership of the network by public safety agencies or their representatives. Each source of funds might require specific governance and oversight measures. The choice of governance, in turn, could provide the leadership needed to implement the network, decisions that would interact with the configuration of spectrum resources.

Funding

The cost of building the mobile broadband network proposed by the FCC was estimated at $18 billion or more in 2007 and the cost for a national network could be as much as $40 billion.[36] The

[35] Some of these groups provided testimony at a hearing in the House of Representatives, Committee on Energy and Commerce, Subcommittee on Communications, Technology, and the Internet, "A National, Interoperable Broadband Network for Public Safety: Recent Developments," September 24, 2009.

[36] Cyren Call Communications Corporation, in *ex parte* comments filed with the FCC on June 4, 2007, set the cumulative capital expenditure for building a public-private network at $18 billion, of which roughly a third of the cost would be for enhancements for public safety use. An estimate from Northrop-Grumman Corporation placed the cost at $30 billion, when service applications are included. (Statement by Mark S. Adams, Chief Architect Networks and Communications, at WCA 2007, Washington, DC, June 14, 2007.) These estimates do not include the cost of radios. An estimated range of $20 billion to $40 billion for network infrastructure was discussed at a House of Representatives hearing held by the Committee on Energy and Commerce, Subcommittee on Communications, Technology, and the Internet, "A National, Interoperable Broadband Network for Public Safety: Recent Developments," September 24, 2009.

actual cost is unknown, but, based on projections for capital expenditures for commercial broadband networks, it will be substantial.[37] These projected costs do not include radios, which must be developed for public safety use on the new network. Congress may choose to use federal funds to cover all or part of the needed investment in infrastructure, and also to identify revenue sources that would cover on-going network operations.

Different types of funding would be available under commercial ownership, government control, or a public-private partnership.

- Commercial ownership. Funding through financial markets, private investors, and other market-driven investment vehicles could be supplemented by federal programs. Tax incentives, low-cost loans, and subsidies are already used to encourage private sector investments that meet a variety of public policy goals.
- Government control. If the licenses are assigned to state and other government administrators, either to supplement or replace the PSBL,[38] many existing federal and state funding systems could be modified to fund capital expenditures and operating expenses for the broadband network. New programs could also be devised at the federal, state, local, or tribal level. Joint ventures with commercial organizations might be used to provide some funding.
- Public-Private partnership. One of the many challenges of a public-private partnership is establishing responsibility for different elements of investment and operations. The partnership might include a means of collecting and distributing fees paid between the partners for use of the network and for use of each other's spectrum. Payments from public safety would come from government funding; payments to public safety would come from investors or revenue streams. The auction rules for the D Block would have assigned to the winner the responsibility for covering capital expenditures and identifying revenue streams.

Summary of Key State and Federal Funding Plans

Proposed funding to support a government-controlled network is usually described as a mixture of federal and state funds, with additional financing provided through agreements with commercial partners. Some of the recommendations for developing the network, such as those provided by NPSTC,[39] assume that the participation of federal, state, or local governments and commercial partners would be negotiated on a local or state basis.

There are two main sources for state and federal funds for public safety: (1) grants awarded for specific programs, and (2) disbursements from funds that are structured to assess fees on economic activity, collect the assessments, and distribute them. The federally sponsored Universal Service Fund (USF) is an assessment program; another assessment model, used by states, counties and local entities, are programs to provide funds for 911 call centers.

[37] Current and projected costs for broadband networks are discussed in CRS Report R40674, *Spectrum Policy in the Age of Broadband: Issues for Congress* , by Linda K. Moore.

[38] The PBSL is assigned to the PSST, a 501 (c) 3 corporation chartered to conform with FCC requirements. See **Appendix B**. Spectrum Allocation and Assignment for Public Safety Needs.

[39] NPSTC, *700 MHz Public Safety Broadband Task Force Report and Recommendations*, September 4, 2009 at http://www.npstc.org/documents/700_MHz_BBTF_Final_Report_0090904_v1_1.pdf. The NPSTC report does not provide cost estimates for its recommendations.

Universal Service Fund

The USF is administered by the Universal Service Administrative Company under the direction of the FCC.[40] It operates four programs to promote telecommunications service as a vital link to emergency services, government services, and communities. The USF is funded by mandatory contributions from telecommunications carriers that provide interstate service. Called the contribution factor, the assessments are a percentage of reported interstate and international end-user telecommunications revenues. The contribution factor is based on anticipated USF funding needs as determined quarterly by the FCC. For the fourth quarter 2009, the contribution factor was set at 12.3% of revenues covered under the contribution factor calculation. For some categories of carriers, such as wireless carriers and interconnected Voice over Internet Protocol carriers, the FCC collects a percentage of estimated revenues using a different formula. Assessed providers are not required to recover USF fees directly from customers but many have chosen to do so by itemizing the fee on monthly telephone bills.[41]

911 Funds

States, counties, and municipalities collect fees—usually levied on cell phone and landline telephone bills—as a source of funds to build and operate 911 call centers. Each state has its own laws governing the collection and disbursement of these fees, and most states permit county and local fee assessments in addition to any state fees. Other sources of dedicated revenue include property taxes and special assessments. Some states have used 911 funds to cover other expenses, as described in a report prepared by the FCC at the request of Congress.[42] Congress has provided a $40 million-plus grant program to improve 911 and enhanced 911 services; states that have used 911 funds for other purposes are not eligible for grants under the program.[43]

Federal Grant Programs

The grant programs most often mentioned in proposals for developing a broadband network for public safety are the Broadband Technology Opportunities Program (BTOP), funded by the American Recovery and Reinvestment Act (ARRA)[44] and the Public Safety Interoperable Communications (PSIC) grant program established by the Deficit Reduction Act of 2005.[45] The NTIA administers BTOP. The NTIA also has responsibility for PSIC, although the actual grant program is administered under an agreement with DHS.[46] BTOP is one of two programs in ARRA aimed at spurring broadband development, the other is a program of grants, loans, and loan/grant

[40] FCC, Consumer and Governmental Affairs Bureau, "The FCC's Universal Service Support Mechanisms" at http://www.fcc.gov/cgb/consumerfacts/universalservice.html.

[41] A comprehensive discussion of the USF program and policy issues is provided in CRS Report RL33979, *Universal Service Fund: Background and Options for Reform*, by Angele A. Gilroy.

[42] FCC, "Report to Congress on State Collection and Distribution of 911 and Enhanced 911 Fees and Charges," submitted pursuant to P.L. 110-283, July 22, 2009 at http://fjallfoss.fcc.gov/edocs_public/attachmatch/DOC-292216A2.pdf.

[43] A discussion of 911 funding and related issues appears in CRS Report RL34755, *Emergency Communications: The Future of 911*, by Linda K. Moore.

[44] P.L. 111-5, Division B, Title VI, 123 STAT. 512 *et seq*.

[45] Network proposals are filed with the FCC under PS Docket No. 06-229.

[46] PSIC is discussed briefly in **Appendix A**. Congressional Efforts on Behalf of Public Safety Communications.

combinations under the Rural Utilities Services, administered by the Department of Agriculture.[47] Grants under PSIC and BTOP must be awarded by the end of FY2010.

Because of the long lead time needed for planning, the public safety mobile broadband network does not seem a likely candidate for stimulus grants[48] or funds from the existing PSIC program, even if extended. Several bills have been introduced that would extend the deadline for PSIC to 2012. (H.R. 1819 and H.R. 3348, Representative Cao, H.R. 3633, Representative Harman, and S. 1694, Senator Rockefeller. S. 1694 and H.R. 3633 are companion bills.) Funding for building narrowband networks at 700 MHz, many of which are "shovel ready" would appear more feasible than for building broadband networks. In general, where the required plans are in place, the narrowband networks could be eligible for grants from PSIC and from the State Fiscal Stabilization Fund of ARRA.[49]

The total amount of funds available in these grants programs is less than the estimated cost of a nationwide, interoperable network. Some states or localities might receive funds for localized needs that would later become part of a national network. Using grants to address the funding needs nationwide would require new appropriations. These grants might be managed through an extension of BTOP or of PSIC, or through a new program, possibly modeled on an existing grant program. There are a number of other programs available for public safety communications and for broadband but they, too, would require additional funds.[50]

Spectrum Auctions as a Source of Funds

One often-mentioned source of funds for federal grants is the proceeds from spectrum auctions. PSIC is funded through revenues from the auction of the airwaves used for analog television. The income, which might eventually include proceeds from the sale of the D Block, goes to the Digital Television Transition and Public Safety Fund, created for that purpose by the Deficit Reduction Act of 2005.[51] The legislation specified disbursements to several grant programs and a payment of $7.36 billion to the U.S. Treasury to reduce the existing budget deficit. Total legislated disbursements were slightly more than $10 billion. The auction, Auction 73, concluded on March 18, 2008; it grossed $19,592,420,000.

There was no provision in the act for disbursing auction proceeds in excess of the amounts specified in the act, although all the "proceeds (including deposits and upfront payments from successful bidders) from the use of a competitive bidding system under this subsection with respect to recovered analog spectrum" were to be deposited into the fund.[52] Any additional disbursements from the fund would be treated as new costs by the Congressional Budget Office

[47] These programs are discussed in CRS Report R40436, *Broadband Infrastructure Programs in the American Recovery and Reinvestment Act*, by Lennard G. Kruger.

[48] P.L. 109-171, Sec. 306 (a) (2) 120 STAT. 24.

[49] P.L. 111-5, Division A, Title XIV, Sec. 1402 (b) (1), 132 STAT. 280.

[50] Existing grant programs are summarized in these CRS reports: CRS Report R40632, *FY2010 Department of Homeland Security Assistance to States and Localities*, by Shawn Reese, and CRS Report RL30719, *Broadband Internet Access and the Digital Divide: Federal Assistance Programs*, by Lennard G. Kruger and Angele A. Gilroy.

[51] "There is established in the Treasury of the United States a fund to be known as the Digital Television Transition and Public Safety Fund." P.L. 109-171, Sec. 3004 (3) "(E) "(i), 120 STAT. 22.

[52] P.L. 109-171, Sec. 3004 (3) "(E) "(ii).

and would need to be offset by new revenue. Unless the law is changed, the surplus in the fund will be deposited in the Treasury as general revenue. The fund, however, has no termination date.

Loan Programs

Separate from ARRA, there is an ongoing loan program under the Rural Utilities Service that can be used for "integrated, interoperable emergency communications" in rural areas.[53] Restrictions on loans available through RUS, however, could severely limit the number of eligible public safety agencies.[54] As with BTOP, even if some loans were made for public safety broadband networks, the narrow scope of the loans would do little to advance the goal of achieving national coverage. However, the RUS model might be used for a loan program that could be applied toward building any part of a public safety network. One of the many questions about how such a program would be structured is: who would receive the loan and guarantee its repayment?

Another model for a program based on loans would be that of a government corporation or some other form of congressionally or federally chartered company. There are different types of federally chartered entities.[55] Some of these entities are essentially private corporations with a government-defined mission, and they raise money from commercial markets. Others, such as government corporations, are entirely government-operated—civil servants staff them—and these corporations borrow funds from the U.S. Treasury. Examples of well-known government corporations include the Government National Mortgage Corporation (Ginnie Mae), a self-sustaining mortgage securities guaranty corporation within the Department of Housing and Urban Development; and the Consolidated Rail Corporation (Conrail), the freight railroad system that was created by the federal government to hold railway assets and later sold to the private sector.

Governance

Decisions about assigning the D Block should include decisions on how to administer its use and that of the adjacent Public Safety Broadband License (PSBL). Choices will be made in the management of these spectrum licenses that could have a defining, long-lasting impact on the advancement of public safety communications. An effective administrative structure could be considered critical to the success of any solution that includes public safety representation. It is important therefore that the parameters of responsibility, regulation, and recourse be clear, no matter how the licenses are assigned.

Many of the proposals before the FCC would combine the public safety and D Block licenses into a single, 20 MHz block. The three administrative models that correspond to the most discussed proposals for this spectrum assignment are

- Private sector. One or more commercial license holders control both the D Block and the PSBL, with or without a requirement to accommodate public safety needs.

[53] P.L. 110-234, Sec. 6107; 122 STAT. 1198.

[54] For additional information on the program, see CRS Report RL33816, *Broadband Loan and Grant Programs in the USDA's Rural Utilities Service*, by Lennard G. Kruger.

[55] Types of federal charters are discussed in CRS Report RS22230, *Congressional or Federal Charters: Overview and Current Issues*, by Kevin R. Kosar.

- Public Sector. Public safety entities hold both licenses, with specific rights assigned to different groups. Some proposals would eliminate the PSBL but all proposals would increase the role of regional, state, and local emergency communications managers and frequency coordinators. Commercial partners might be included in the mix.
- Public-Private Partnership. The PBSL and one or more commercial licenses are assigned rights and responsibilities by the FCC and agree to cooperate on network and spectrum sharing.

With appropriate governance, the choice among alternatives for ownership of the licenses is a policy decision more than a business decision. A commercial owner or owners would be more likely to follow FCC policies for spectral efficiency and consumer service; public safety ownership might be guided by local, state, or federal policies, including the National Emergency Communications Plan. Dual ownership, the third alternative, could balance the two policies, or could lead to disequilibrium and a failed partnership. Concerns about how the FCC would maintain an equitable partnership through its regulatory authority was one of the uncertainties that may have contributed to the failed auction of the D Block.

Assigning a license to a public-safety designee may have been an expedient way to assure that Congress's requirement for assigning frequencies "for public safety services" was fulfilled.[56] The PBSL may not be necessary for effective governance of a shared national network that benefits public safety. The FCC might reconsider both the mission of the PSBL and its funding needs. Other formulae for representing public safety interests might be considered by the FCC, and possibly by Congress.

The Role of the Federal Government

Whatever the decision about spectrum assignment, the federal government can be expected to play a crucial role in assisting or protecting its oft-stated goals of public safety interoperability and capacity. How federal leadership will be provided is less certain.

Congress has separately conferred authority on DHS and the FCC to act on behalf of public safety. In the case of DHS, this includes requirements to coordinate and support specific goals, such as interoperability and a national communications capability.[57] None of the actions required of DHS relate specifically to using 700 MHz spectrum to achieve these objectives. The FCC brings to the process several important mandates from Congress, such as an obligation to "promote safety of life and property through the use of wire and radio communication,"[58] as well as specific instructions regarding the assignment of frequencies at 700 MHz.

Many of the instructions from Congress regarding planning for public safety have included requirements for collaboration between the FCC and DHS. According to the Government

[56] The statute required that, of analog television broadcast spectrum scheduled to be cleared, allocations would include "24 megahertz of that spectrum for public safety services according to the terms and conditions established by the Commission in consultation with the Secretary of Commerce and the Attorney General." 47 U.S.C. 337.

[57] Discussed in detail in **Appendix A**. Congressional Efforts on Behalf of Public Safety Communications.

[58] 47 U.S.C. § 151. The FCC relied partly on this authority in requiring the relocation of commercial licenses because transmissions were interfering with public safety radio communications in the 800 MHz band. See CRS Report RL32408, *Spectrum Policy: Public Safety and Wireless Communications Interference*, by Linda K. Moore.

Accountability Office (GAO), there is little evidence of cooperation between the two agencies. DHS, in particular, is faulted by the GAO for its slowness in creating the Emergency Communications Preparedness Center, one of several collaborative initiative required by Congress.[59] The lack of coordination between DHS, the FCC, and other agencies was raised as a policy concern in a January 2007 CRS report.[60]

Concept: Managing Technology and Spectrum Resources

Within the federal government, DHS has authority for planning and implementing public safety communications solutions. The FCC created a Public Safety and Homeland Security Bureau in 2006 to consolidate its many programs oriented toward public safety.[61] The bureau, along with the Wireless Telecommunications Bureau, has authority over the PSST as the chosen license-holder for the public safety broadband frequencies. The FCC, the PSST, and DHS has each approached the goal of communications interoperability from a different perspective, with different concepts of the role of standards and technology. The following discussion of concept provides snapshot summaries of the approaches adopted by the two agencies and the technologies and network design concepts that might be applied through the PSST. The section also discusses the trend to Internet-based concepts for networks and spectrum management.

Ideas for managing emergency communications have moved along an evolutionary path from the 1990s, when agreement was reached on developing standards for interoperable communications, to the system-of-systems concept embraced by DHS, to the network-oriented proposals of the FCC, PSST, and NPSTC. The ubiquity of the Internet and the standards that support it are leading to a new path for managing spectrum and network resources.

System-of-Systems

The communications solutions advocated by DHS have focused on developing what is often referred to as a "system of systems." The choice of terminology implies that independent systems are made to work with each other through bridges and gateways that connect incompatible technology choices into a larger system. This approach maximizes the value of past investments but does not represent an efficient use of resources. Backward-compatible radio equipment that can support several generations of different technologies, for example, is more expensive than equipment designed to work only with newer network technology. Spectrum usage is inefficient because more than one channel is often used to convey a single communication from system to system.

Essentially, the system-of-systems concept starts with the radio user and works its way up, adding and connecting the different levels of command and control needed to respond to specific situations. DHS refers to this as a practitioner-driven approach. Many of the DHS programs for public safety have focused on achieving interoperability within the existing framework of proprietary systems and by expanding the diffusion of Project 25, or P25, standards.[62] Backward

[59] GAO, *Emergency Communications: Vulnerabilities Remain and Limited Collaboration and Monitoring Hamper Federal Efforts*, June 2009, GAO-09-604.

[60] CRS Report RL33838, *Emergency Communications: Policy Options at a Crossroads*, by Linda K. Moore.

[61] See http://www.fcc.gov/pshs/about-us/.

[62] P25 conforms to recommendations made in 1996 by the Public Safety Wireless Advisory Committee (PSWAC) (continued...)

compatibility with legacy systems is one of the principles behind the digital radio and interoperable gateway[63] standards of P25. Its use is advocated by many public safety agencies and by DHS.[64] P25-compliant technologies coordinate and connect specified radio channels.[65]

Currently, the Command, Control and Interoperability Division, of the Science and Technology Directorate at DHS, is testing and evaluating P25 multi-band radios.[66] The initial phase of the program was announced July 1, 2009. Results will be documented in a report that "will provide details to manufacturers about the needs of the response community and assist officials in making informed radio purchasing decisions in the future."[67]

Shared Networks

The FCC took a more network-oriented approach to achieving interoperability by laying out a plan for a national network at 700 MHz that would eventually reach every community with the same technology and connectivity, providing a common base for individual applications. Network-centric solutions start with the network framework, which sets a common standard. Any traffic that wants to use this network has to accommodate that standard (although it can use additional standards as well). Network-centric solutions tend to be top down, with centralized control of core decisions. The FCC attempted to structure a central administration in which both public safety and a commercial network operator would have equal say, with the FCC arbitrating differences. Difficulties in balancing the rights and responsibilities of two separate license-holders contributed to the failure to auction the D Block.

Interconnected Networks

The Public Safety Spectrum Trust (PSST) was assigned the Public Safety Broadband License (PSBL) as part of the FCC's plans to create a public-private partnership. The PSST considers that the new broadband network will serve primarily as a data exchange network (text, photos, video, etc.) that would operate as an adjunct to the current mission critical public safety voice systems. Existing voice communications systems and new narrowband systems at 700 MHz would operate

(...continued)

regarding the improvement of public safety communications over wireless networks, see "Final Report of the Public Safety Wireless Advisory Committee," September 11, 1996. The committee was disbanded after publication of its recommendations. The Association for Public-Safety Communications Officials—International (APCO) is a principle player in the development of P25 standards. Currently, meetings to develop standards are managed by the Telecommunications Industry Association, an ANSI-standards-setting body. See http://www.tiaonline.org/standards/technology/project_25/index.cfm/.

[63] Gateways, the current solution for interoperability, can connect radios using different technologies and frequencies.

[64] Guidance for standards are included, for example in "Recommended Guidance for Federal Grant Programs," at http://www.safecomprogram.gov/NR/rdonlyres/9DFFF882-1895-47F5-B724-9808BF1F9FE9/0/FY2009SAFECOMRecommendedGuidanceforFederalGrantProgramsFINAL110408.pdf.

[65] A useful description of the development, benefits, and disadvantages of P25 was issued by the Department of Justice in 2007: Issue Brief Number 6, "Project 25: The Quest for Interoperable Radios," by Dan Hawkins, May 2007 at http://www.cops.usdoj.gov/files/ric/Publications/project25interopradios.pdf.

[66] Multi-band radios facilitate switching from one frequency to another in as many as four different bands.

[67] DHS Press Release, "DHS Announces Sites for Multi-Band Radio Pilot," July 1, 2009 at http://www.dhs.gov/ynews/releases/pr_1246478388904.shtm.

independently of the broadband network with an interface to be established in a future development phase.[68]

The Board of Directors of the PSST has agreed to consider recommendations from the NPSTC Broadband Task Force[69] and to submit those recommendations that it accepts to the FCC for consideration.[70] The Task Force has also recommended that NPSTC, its member organizations, and the PSST should begin a coordinated effort to have the D Block frequencies allocated for public safety use and assigned to the PSST as the designated holder of the PSBL.

Recommendations to the PSST

The preponderance of the Broadband Task Force's recommendations were oriented toward paving the way for the early construction of networks by states and cities. The interoperable framework provided by the task force is based on connecting independent public safety networks. Interoperability would be facilitated by a number of guiding principles and requirements, such as access to the Internet and IP-based voice interoperability gateways. In general, the recommendations of the task force would facilitate these expectations.

- Regional (including state and local) broadband systems will operate within the framework of a Nationwide Broadband Data System (NBDS).
- The NBDS will use Long Term Evolution (LTE) technology and it is assumed that regional systems will as well.
- Defining minimum requirements for public safety broadband networks at 700 MHz will enable national interoperability.
- An advisory council will provide governance among individual operators and the PSBL.
- Public-private partnerships will be allowed.
- Different scenarios for assignment of the D Block will be accommodated by the Task Force requirements and recommendations.
- Regional operators will have the right to deploy systems in advance of final requirements and to select and deploy applications beyond what is required.
- Technical requirements will be specified to facilitate roaming and interoperability.
- Those that have filed requests to the FCC for permission to build systems will be able to fulfill their 700 MHz broadband objectives as quickly as possible.

[68] This is the description supplied by PSST, the current Public Safety Broadband Licensee, in an e-mail from Chief Harlin R. McEwen to CRS on August 3, 2009. A similar description was provided in testimony by Chief McEwen at the hearing held by the House of Representatives, Committee on Energy and Commerce, Subcommittee on Communications, Technology, and the Internet: "A National, Interoperable Broadband Network for Public Safety: Recent Developments," September 24, 2009.

[69] NPSTC, *700 MHz Public Safety Broadband Task Force Report and Recommendations*, September 14, 2009 at http://www.npstc.org/documents/700_MHz_BBTF_Final_Report_0090904_v1_1.pdf.

[70] NPSTC Press Release, "NPSTC Votes to Send 700 MHz Broadband Task Force Report to Public Safety Spectrum Trust," September 15, 2009.

- Best practices for network architecture and configurations will be provided but not required.

The technical and operational requirements focus on steps that need to be taken so that a small number of public safety agencies may have access to additional spectrum for networks in their areas, before plans for a national network are completed. The Task Force has proposed that these early initiatives might serve as trial programs, used to help guide the development of a national network. The Task Force's report does not impede the creation of a national network but it also does not provide a plan to implement one. Instead it has developed technical requirements for internetwork roaming and proposed that the PSBL and regional operators emulate telephone companies in order to administer roaming agreements.[71] The NPSTC recommendations do not address the specific costs of building, operating, and connecting separate networks. The members of the Task Force, all volunteers, have provided recommendations that might serve as the basis for future decisions. Their work needs to be developed into a full model for standardization, with appropriate governance and oversight. Means to provide funding for planning, capital investment, and operating costs must also be identified.

The Association for Public-Safety Communications Officials—International (APCO) subsequently announced its intention to develop standards for the broadband networks at 700 MHz. Specifically, APCO "will identify gaps and set standards in those areas where none currently exist and where standards are necessary to ensure roaming and interoperability" and will "establish basic requirements necessary to ensure interoperability" for the network.[72] APCO is accredited by the American National Standards Institute as a Standards Development Organization.

The National Emergency Number Association (NENA), which is a member both of NPSTC and the PSST board, provided a dissenting opinion to the task force's recommendations. NENA has advocated combining the D Block and the public safety license assigned to the PSST for auction to a commercial operator, with requirements for public safety access. Auction proceeds would be set aside to fund public safety costs. In a letter intended to accompany the report sent to PSST, NENA expressed concerns about funding and the possibility that "public safety need for spectrum may be negated by the opportunity to lease excess capacity. "[73]

IP-Enabled Networks

As part of the discussion about how to bring broadband to public safety users, several organizations have recommended Long Term Evolution (LTE), a fourth-generation wireless

[71] "In order for roaming and more specifically authentication to be enabled, there must be several interfaces that are connected between each home and visited network. To support this, multiple leased lines would be required, thus putting a large technical and financial burden on the public safety network. Commercial service providers traditionally use third party clearinghouses to provide their roaming authentication and internetworking. . . .

"Public safety should utilize similar methodologies for roaming to enable them the most flexibility and cost savings. A third party commercial internetworking provider can support a common authentication scheme for all public safety networks, thus supporting both inter- and intra-network roaming." *700 MHz Public Safety Broadband Task Force Report and Recommendations*, page 61.

[72] APCO News, "APCO Announces Intent to Develop Standards for Build Out of 700 MHz Broadband Network," October 14, 2009 at http://www.apcointl.org/new/news/standards_700mhz.php.

[73] Letter to Marilyn Ward, Executive Director, NPSTC from Brian Fontes, Chief Executive Officer, NENA, September 17, 2009 at http://www.npstc.org/documents/NENA_letter_re_BBTF_Final_Report.pdf.

technology,[74] for the underlying network infrastructure on the 700 MHz frequencies.[75] Fourth-generation technologies are being designed to maximize the effectiveness of wireless broadband communications. They are being developed to use Internet Protocol (IP) standards, assuring a high degree of interoperability among other IP-based technologies. Developing standards for public safety interfaces on LTE networks could represent a shift in concept for public safety communications—to IP-based platforms and communications management at the network level. Some public safety representatives have shown a willingness to move from a model that connects disparate systems to a model that provides interoperability through network administration. This shift in support could presage a move to more spectrally efficient technologies and IP-enabled networks.[76]

Some states have decided to deploy IP-enabled fiber optic networks to support their communications needs, including those of public safety.[77] These networks use IP standards to achieve the same level of interoperability, availability, and flexibility associated with the Internet but do not necessarily link to the Internet.

Congress has recognized the value of IP-based networks for 911 communications by, for example, requiring the NTIA and the National Highway Traffic Safety Administration to prepare recommendations that would support the transition of out-dated 911 systems to IP-based technologies.[78] Congress has not previously considered giving the same attention to the adoption of IP-based technologies for public safety radio communications.

Adaptive Network Technologies

The FCC, DHS, PSST, and NPSTC approaches to interoperability, although different in perspective, are all based on managing radio channels as the way to meet common goals such as minimizing interference among wireless transmissions.

The concept of channel management dates to the development of the radio telegraph by Guglielmo Marconi and his contemporaries. In the United States, mitigation of radio interference was addressed in what is commonly known as the Radio Act of 1912. Passage of the bill, versions of which had been introduced in earlier Congresses, was prompted in part by Marconi's testimony at a congressional hearing investigating the sinking of the Titanic. The act established the basic principle of assigning licenses for specific channels through a central federal authority, which became the FCC with the passage of the Communications Act of 1934.

[74] A discussion of broadband technology is include in CRS Report R40674, *Spectrum Policy in the Age of Broadband: Issues for Congress* , by Linda K. Moore.

[75] APCO and NENA jointly endorsed LTE . NPSTC, and the PSST are among those that also have endorsed LTE.

[76] In an interview, Richard Mignon, the incoming president of APCO, observed that broadband is "the future of public safety communications.... It's almost like reinventing public safety technology and how we work together." As reported in MissionCritical Communications TRANSMISSION, e-newsletter, August 19, 2009.

[77] These are Florida, Indiana, Minnesota, New Mexico, and Rhode Island. Source: NENA, Status of NG9-1-1 Related IP Networks, Demos and Trials at http://www.nena.org/pages/Content.asp?CID=373&CTID=65. According to the Department of Transportation, Vermont has also established an IP backbone and numerous regional/local networks are upgrading to an IP-based network. Source: e-mail communication from Will Otero, Director, Legislative Affairs, National Highway Traffic Safety Administration, October 21, 2008.

[78] Next Generation 911 technologies and congressional actions in support of 911are discussed in CRS Report RL34755, *Emergency Communications: The Future of 911*, by Linda K. Moore.

In the age of the Internet, however, channel management is an inefficient way to provide spectrum capacity for mobile broadband.[79] Innovation points to network-centric spectrum management as an effective way to provide spectrum capacity to meet the bandwidth needs of fourth-generation wireless devices. Network-centric technologies organize the transmission of radio signals along the same principle as the Internet. A transmission moves from origination to destination not along a fixed path but by passing from one available node to the next. Pooling resources, one of the concepts that powers the Internet now, is likely to become the dominant principle for spectrum management in the future.

The iPhone 3G and 3GS provide early examples of how the Internet is likely to change wireless communications as more and more of the underlying network infrastructure is converted to IP-based standards. The iPhone uses Internet protocols to perform many of its functions; these require time and space—spectrum capacity—to operate.

The core Internet Protocol (TCP/IP) was conceived to work with high capacity landline networks. In a wireless environment, IP applications are bandwidth-intensive, consuming large amounts of channel capacity. Although future generations of mobile broadband devices will no doubt use IP applications that have been refined for the wireless environment, additional capacity will still be required to handle expected increases in activity.

More efficient spectrum use can be realized by integrating adaptive networking technologies, such as dynamic spectrum access (DSA),[80] with IP-based commercial network technologies such as LTE. Radios using DSA chipsets are more effective at managing interference and congestion than the channel management techniques currently in use. If a channel's link fails, the radio is cut off. When radios are networked using DSA, individual communications nodes continue to operate and can compensate for failed links. The effects of interference are manageable rather than catastrophic. The network is used to overcome radio limitations.

Adaptive networking has the potential to organize radio communications to achieve the same kinds of benefits that have been seen to accrue with the transition from proprietary data networks to the Internet. Adaptive technologies are designed to use pooled spectrum resources. Pooling spectrum licenses goes beyond sharing. Licenses are aggregated and specific ownership of channels becomes secondary to the common goal of maximizing network performance. For many, the construction of a new network for public safety communications represents an opportunity to reap the perceived benefits of shared infrastructure and pooled spectrum by using the technologies and principles of network-centric operations.

Network-Centric Spectrum Management

The Department of Defense (DOD) is working to implement network-centric operations (NCO) through a number of initiatives.[81] Leadership and support to achieve DOD goals in the crucial

[79] A leading advocate for replacing channel management of radio frequency with network-centric management is Preston Marshall, the source for much of the information about network-centric technologies in this report. Mr. Marshall is Director, Information Sciences Institute, University of Southern California, Viterbi School of Engineering, Arlington, Virginia. CRS also spoke with other experts who provided background on the topic.

[80] Dynamic Spectrum Access, Content-Based Networking, and Delay and Disruption Technology Networking, along with cognitive radio, and decision-making software, are examples of technologies that can enable Internet-like management of spectrum resources.

[81] A discussion of the goals of NCO is included in CRS Report RL32411, Network Centric Operations: Background (continued...)

area of spectrum management is provided by the Defense Spectrum Organization (DSO) created in 2006 within the Defense Information Systems Agency (DISA). The DSO is leading DOD efforts to transform spectrum management in support of future net-centric operations and warfare, and to meet military needs for dynamic, agile, and adaptive access to spectrum. The DSO is guiding DOD spectrum management along a path that envisions moving away from stove-piped systems to network-centric spectrum management and, ideally, to bandwidth on demand and cognitive self-synching spectrum use.

Among the steps to advance toward the goal of spectrum access that is fully adaptable to any situation, is the testing of network-centric technologies developed by the Defense Advanced Research Projects Agency (DARPA) within the Wireless Network After Next (WNaN) program. WNaN is evaluating DSA, Disruptive Tolerant Networking, and other tools, possibly to replace the existing Joint Tactical Radio System (JTRS) now in use. JTRS uses software-programmable radios to provide interoperability, among other features.[82] WNaN's testing and evaluation of network-centric technologies is anticipated to begin in December 2009, with a decision expected in late 2010. WNAN technology is planned for transition to the Army in 2010.[83]

DOD's long-term strategy for implementing new spectrum management technologies and techniques revolves around the Global Electromagnetic Spectrum Information System (GEMSIS). GEMSIS will transform spectrum operations from a preplanned and static frequency assignment system into a responsive and supple capability to request, assign, allocate, and de-conflict designated portions of radio frequency spectrum. Its goals include

- Enable operational forces through significantly improved spectrum operations.
- Provide net-centric, interoperable, integrated, and collaborative joint-spectrum management capabilities.
- Increase and accelerate spectrum efficiency and operational effectiveness.
- Adopt a common spectrum data exchange format, minimize data duplication, and enhance the spectrum common operational picture.
- Implement standard web services and network-centric solutions.

As a combat support agency, the ultimate goal for GEMSIS is to enable warfighters to more effectively and efficiently manage the electromagnetic battlespace to achieve information dominance.[84]

The goals for GEMSIS are in the main the same as those of first responders. One of the support functions of GEMSIS is interoperability with federal, state, and local government spectrum agencies. GEMSIS will also support the coordination of spectrum resources and access in global

(...continued)

and Oversight Issues for Congress, by Clay Wilson (archived).

[82] Information at http://jpeojtrs.mil/.

[83] Information about the WNaN program is based on comments by Bob Wilson, Deputy Program Manager for Army WNaN program, Communications-Electronics Command at DoD Spectrum Symposium, Arlington, VA, October 14-15, 2009.

[84] Information about GEMSIS is based on background provided by Paige Atkins, Director, Defense Spectrum Organization, including comments at DoD Spectrum Symposium, Arlington, VA, October 14-15, 2009.

disaster relief. Through these activities, GEMSIS could be a conduit for transferring DOD's advanced technologies and spectrum management tools to first responders.

Conclusion

Homeland security depends on effective communications for prevention, preparedness, and response to a range of threats. First responders and the larger public safety community that supports them rely heavily on effective radio communications to meet their responsibilities for homeland security. More important to the average American is the role that public safety services play in daily life and in responding to natural disasters. Flash floods, forest fires, tornados, hurricanes—Mother Nature provides endless variations for the scenarios of response and recovery.

The FCC and DHS have different perspectives on radio technology and infrastructure. DHS policies favor reliability and familiarity in their requirements and guidelines for technology and in their emphasis on training and repeated use of equipment. Spectrum policy at the FCC promotes spectrum efficiency and competition among commercial license-holders.

Neither the FCC nor the DHS agencies that support public safety communications appear to have considered preparing public safety communications for the coming generations of wireless technology.[85] Leadership in mobile broadband innovation has come from information technology companies that have forged partnerships with wireless companies, and from specialized new ventures. It also comes from the Department of Defense, which is embracing network-centric technologies for a variety of uses, including mobile broadband.

Models for Change

The 9/11 Commission Report included several recommendations to improve the communications capabilities of first responders. To provide communications interoperability, it recommended that major urban areas should establish—and receive federal funding priority for this purpose—"signal corps units to ensure communications connectivity between and among civilian authorities, local first responders, and the National Guard.[86] Building on this, Congress recommended using the Army Signal Corps[87] as a model for interoperability. For example, one law directed the Secretary of Homeland Security to consult with the Secretary of Defense in the development of two test projects, including review of standards, equipment, and protocols.[88] In

[85] However, FCC Commissioner Meredith Attwell Baker, in testimony before Congress, mentioned spectrally efficient technologies developed by DARPA for the Department of Defense. Hearing, House of Representatives, Committee on Energy and Commerce, Subcommittee on Communications, Technology, and the Internet, "Oversight of the Federal Communications Commission," September 17, 2009. The NTIA, in coordination with the FCC and federal agencies, has begun a Spectrum Sharing Innovation Test-Bed Pilot Program to evaluate the ability of DSA technologies to share spectrum with Land Mobile Radio systems, see http://www.ntia.doc.gov/frnotices/2006/spectrumshare/comments.htm. The report on Phase I of the program was published in February 2009, see http://www.ntia.doc.gov/frnotices/2006/spectrumshare/Phase_I_Test_Plan_Final_Version_NTIA_Website.pdf.

[86] *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States*, Washington: GPO, 2004, p. 397.

[87] The Army Signal Corps is a combat support unit with a mission that includes communications support. See http://www.us-army-info.com/pages/mos/signal/signal.html.

[88] P.L. 108-458, Title VII, Subtitle C, Sec. 7304, 118 STAT. 3847-3848.

setting requirements for the preparation of the National Emergency Communications Plan, Congress required an evaluation of the feasibility of developing a mobile communications capability modeled on the Army Signal Corps, in cooperation with the Department of Defense.[89]

Congress showed foresight in looking to the U.S. military for models of how to organize diverse resources (people and infrastructure) to achieve interoperability for emergency communications. In that context, both Congress and the 9/11 Commission have recognized the link between deploying wireless equipment and accessing spectrum to use it. Network-centric technologies and management techniques now being implement by DOD might provide conceptual models for a new network for public safety.

Opportunities for Change

Congress has before it an opportunity to bring public safety communications into the 21st century by assuring that a nationwide, interoperable communications network is put in place. The tools at its disposal include homeland security policy, spectrum policy, funding programs, and leadership. Congress has passed legislation in the past that was intended to sharpen these tools, but each action has taken place as a separate program. There has been no coalescence of the necessary resources. The FCC's initial plans for a public-private partnership to build a network for public safety represented a first attempt to bring the needed elements together. Congress may be able to assist in bringing the second attempt to successful realization.

Among the actions that Congress might take, those dealing with governance and funding are often cited by public safety officials as the areas most in need of its consideration. For the proposed network project to go forward on a sustainable footing, funding sources need to be identified for investment and operating expenses over the long term. To ensure the resources are wisely used, analysts point to the primacy of putting in place a well-grounded but flexible governance structure. There is much to protect: the value of public safety and personal security and the value of radio frequency spectrum—not only the dollars it might fetch at auction but also the value of the innovation and growth that it can foster.

[89] P.L. 109-295, Title VI, Sec. 671(b), 'Title XVIII, 'Sec. 1803, 120 STAT. 1437-1438.

Appendix A. Congressional Efforts on Behalf of Public Safety Communications

Congress first addressed the issue of emergency communications interoperability in the Homeland Security Act of 2002 (P.L. 107-296). Two years later, responding to recommendations of the National Commission on Terrorist Attacks Upon the United States (9/11 Commission), Congress included a section in the Intelligence Reform and Terrorism Prevention Act of 2004 (P.L. 108-458) that expanded its requirements for action in improving interoperability and public safety communications. Also in response to a recommendation by the 9/11 Commission, Congress set a firm deadline for the release of radio frequency spectrum needed for public safety radios, as part of the Deficit Reduction Act of 2005 (P.L. 109-171). These laws provided the base from which the Department of Homeland Security (DHS) could develop a national public safety communications capability as required by the Homeland Security Appropriations Act, 2007 (P.L. 109-295). Title VI, Subtitle D of the act, referred to as the 21st Century Emergency Communications Act of 2006, placed new requirements on DHS. Additional requirements were included in the Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53).

The Homeland Security Act of 2002 and Actions by the Department

Provisions of the Homeland Security Act instructed DHS to address some of the issues concerning public safety communications in emergency preparedness and response and in providing critical infrastructure. Telecommunications for first responders is mentioned in several sections, with specific emphasis on technology for interoperability.[90]

The newly created DHS placed responsibility for interoperable communications within the Directorate for Science and Technology, reasoning that the focus of DHS efforts would be on standards and on encouraging research and development for communications technology. Responsibility to coordinate and rationalize federal networks, and to support interoperability, had previously been assigned to the Wireless Public SAFEty Interoperable COMmunications Program—called Project SAFECOM—by the Office of Management and Budget as an e-government initiative. With the support of the George W. Bush Administration, SAFECOM was placed in the Science and Technology directorate and became the lead agency for coordinating federal programs for interoperability.[91] The Secretary of Homeland Security assigned the responsibility of preparing a national strategy for communications interoperability to the Office of Interoperability and Compatibility (OIC), which DHS created, an organizational move that was later ratified by Congress in the Intelligence Reform and Terrorism Prevention Act.[92] SAFECOM continued to operate as an entity within the OIC, which assumed the leadership role.

[90] Notably, P.L. 107-296, Sec. 232, 116 STAT. 2159 and Sec. 502, 116 STAT. 2213.

[91] "Homeland Security Starting Over With SAFECOM," *Government Computer News*, June 9, 2003.

[92] P.L. 108-458, Title VII, Subtitle C, Sec. 7303 (a) (2), 118 STAT. 3843-3844.

Intelligence Reform and Terrorism Prevention Act

Acting on recommendations made by the 9/11 Commission, Congress included several sections regarding improvements in communications capacity—including clarifications to the Homeland Security Act—in the Intelligence Reform and Terrorism Prevention Act (P.L. 108-458).

The Commission's analysis of communications difficulties on September 11, 2001, was summarized in the following recommendation.

> Congress should support pending legislation which provides for the expedited and increased assignment of radio spectrum for public safety purposes. Furthermore, high-risk urban areas such as New York City and Washington, D.C., should establish signal corps units to ensure communications connectivity between and among civilian authorities, local first responders, and the National Guard. Federal funding of such units should be given high priority by Congress.[93]

Congress addressed both the context and the specifics of the recommendation for signal corps capabilities. The Intelligence Reform and Terrorism Prevention Act amended the Homeland Security Act to specify that DHS give priority to the rapid establishment of interoperable capacity in urban and other areas determined to be at high risk from terrorist attack. The Secretary of Homeland Security was required to work with the Federal Communications Commission (FCC), the Secretary of Defense, and the appropriate state and local authorities to provide technical guidance, training, and other assistance as appropriate. Minimum capabilities were to be established for "all levels of government agencies," first responders, and others, including the ability to communicate with each other.[94] The act further required the Secretary of Homeland Security to establish at least two trial programs in high-threat areas. The process of development for these programs was to contribute to the creation and implementation of a national model strategic plan. The purpose was to foster interagency communications at all levels of the response effort. Building on the concept of using the Army Signal Corps as a model, the law directed the Secretary to consult with the Secretary of Defense in the development of the test projects, including review of standards, equipment, and protocols.[95]

Congress also raised the bar for performance and accountability, setting program goals for the Department of Homeland Security. Briefly, the goals were to:

- Establish a comprehensive, national approach for achieving interoperability;
- Coordinate with other federal agencies;
- Develop appropriate minimum capabilities for interoperability;
- Accelerate development of voluntary standards;
- Encourage open architecture and commercial products;
- Assist other agencies with research and development;

[93] *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States*, Washington: GPO, 2004, p. 397.

[94] P.L. 108-458, Title VII, Subtitle C, Sec. 7303, 118 STAT. 3843 *et seq*.

[95] P.L. 108-458, Title VII, Subtitle C, Sec. 7304, 118 STAT. 3847-3848.

- Prioritize, within DHS, research, development, testing and related programs;
- Establish coordinated guidance for federal grant programs;
- Provide technical assistance; and
- Develop and disseminate best practices.

The act included a requirement that any request for funding from DHS for interoperable communications "for emergency response providers" be accompanied by an Interoperable Communications Plan, approved by the Secretary. Criteria for the plan were also provided in the act.[96]

The act also provided a sense of Congress that the next Congress—the 109th—should pass legislation supporting the Commission's recommendation to expedite the release of spectrum. This was addressed in the Deficit Reduction Act of 2005 (P.L. 109-171).

The Homeland Security Appropriations Act, 2007

The destruction caused by Hurricanes Katrina and Rita in August-September 2005 reinforced the recognition of the need for providing interoperable, interchangeable communications systems for public safety and also revealed the potential weaknesses in existing systems to withstand or recover from catastrophic events. Testimony at numerous hearings following the hurricanes suggested that DHS was responding minimally to congressional mandates for action, most notably as expressed in the language of the Intelligence Reform and Terrorism Prevention Act. Bills subsequently introduced in both the House and the Senate proposed strengthening emergency communications leadership and expanding the scope of the efforts for improvement. Some of these proposals were included in Title VI of the Homeland Security Appropriations Act, 2007 (P.L. 109-295). Title VI—the Post-Katrina Emergency Management Reform Act of 2006—reorganized the Federal Emergency Management Agency (FEMA), gave the agency new powers, and clarified its functions and authorities within DHS.[97]

The act also addressed public safety communications in Title VI, Subtitle D—the 21st Century Emergency Communications Act of 2006. This section created an Office of Emergency Communications (OEC)) and the position of Director, reporting to the Assistant Secretary for Cybersecurity and Communications. The Director was required to take numerous steps to coordinate emergency communications planning, preparedness, and response, particularly at the state and regional level. These efforts were to include coordination with Regional Administrators appointed by the FEMA Administrator to head ten Regional Offices. To assist these efforts, Congress required FEMA to create Regional Emergency Communications Coordination (RECC) Working Groups.[98]

Other responsibilities assigned to the Director included conducting outreach programs, providing technical assistance, coordinating regional working groups, promoting the development of standard operating procedures and best practices, establishing non-proprietary standards for

[96] P.L. 108-458, Title VII, Subtitle C, Sec. 7303 118 STAT. 3843 *et seq*.

[97] Information on the FEMA reorganization is provided in CRS Report RL33729, *Federal Emergency Management Policy Changes After Hurricane Katrina: A Summary of Statutory Provisions*, coordinated by Keith Bea.

[98] P.L. 109-295, Title VI, Sec. 671(b), 'Title XVIII, 'Sec. 1805, 120 STAT. 1439.

interoperability, developing a national communications plan, working to assure operability and interoperability of communications systems for emergency response, and reviewing grants. Required elements of the National Emergency Communications Plan included establishing requirements for assessments and reports, and an evaluation of the feasibility of developing a mobile communications capability modeled on the Army Signal Corps. The feasibility study was to be done by DHS on its own or in cooperation with the Department of Defense. Congress also required assessments of emergency communications capabilities, including an inventory that identified radio frequencies used by federal departments and agencies.[99]

Many of the functions Congress envisioned for the OEC were later assumed by the Command, Control and Interoperability Division in the Directorate of Science and Technology.

Regional Emergency Communication Coordination

Congress directed the OEC to coordinate with the Regional Emergency Communication Coordination (RECC) Working Groups established by FEMA.[100] These groups could provide a platform for coordinating emergency communications plans among states and were intended to include representatives from many sectors with responsibility for public safety and security. Plans for forming RECCs were announced in December 2007. In 2008 organization charts were developed, graphing how the RECCs were structured and where they would fit in the existing chain-of-command of the Federal Emergency Management Agency (FEMA). A National RECC Coordinator was appointed and plans were announced to appoint administrators for each of the regions.

A key proposal for the RECC structure is to "Establish and use the RECC's as a single Federal emergency communications coordination point for Federal interaction with the State, local and tribal governments."[101] It is not clear at this early stage whether the RECCs will become an effective conduit for interaction to develop policies and plan for shared infrastructure or a forum for FEMA's Disaster Operations Directorate to relay guidelines and orders. Congress placed an emphasis on assisting first responders in its statement of RECC goals but did not limit the RECCs' ability to set more inclusive goals. Based on the role of RECCs as assigned by the National Emergency Communications Plan, their focus will be narrowly on assisting first responders to prepare for disaster response. Leadership will be provided by FEMA and governance will be through the chain-of-command of the agencies' directorates.

The formation of the regional working groups, the RECCs, responded in part to requests from the public safety community to expand interoperable communications planning to include the second tier of emergency workers. Non-federal members of the RECC are to include first responders, state and local officials and emergency managers, and public safety answering points (911 call centers). Additionally, RECC working groups are to coordinate with a variety of communications providers (such as wireless carriers and cable operators), hospitals, utilities, emergency

[99] P.L. 109-295, Title VI, Sec. 671(b), 'Title XVIII, 'Sec. 1803, 120 STAT. 1437-1438.

[100] P.L. 109-295, Title VI, Sec. 671(b), "Title XVIII, "Sec. 1805, 120 STAT. 1439.

[101] Presentation by Brian Carney, National RECC Coordinator, Disaster Operations Directorate, Federal Emergency Management Agency, Department of Homeland Security, "Regional Emergency Communications Coordination Working Groups (RECCWG)" at National Public Safety Telecommunications Council (NPSTC), Seattle, Washington, September 15, 2008 at http://www.npstc.org/meetings/GB_Carney_RECC%20Briefing_090208_NPSTC.ppt.

evacuation transit services, ambulance services, amateur radio operators, and others as appropriate.

National Emergency Communications Plan

In compliance with requirements of the Homeland Security Appropriations Act, 2007, the Department of Homeland Security issued the National Emergency Communications Plan (NECP) in July 2008.[102]

The NECP sets three goals for levels of interoperability[103]

- By 2010, 90% of all areas designated within the Urban Areas Security Initiative (UASI) will demonstrate response-level emergency communications, as defined in grant programs, within one hour for routine events involving multiple jurisdictions and agencies.
- By 2011, 75% of non-UASI will have achieved the goal set for UASIs.
- By 2013, 75% of all jurisdictions will be able to demonstrate response-level emergency communications within three hours for a significant incident as outlined in national planning scenarios.

These jurisdictional goals are to be knit together into a national communications capability through program efforts such as FEMA's Regional Emergency Communications Coordination (RECC) Working Group. The three goals are bolstered by seven objectives for improving emergency communications for first responders, dealing largely with organization and coordination.[104] Each of these objectives have "Supporting Initiatives" and milestones.

Deficit Reduction Act of 2005 and the Public Safety Interoperability Grant Program

Provisions in the Deficit Reduction Act of 2005 planned for the release of spectrum by February 18, 2009[105] and created a fund to receive spectrum auction proceeds and disburse designated sums to the Treasury and for other purposes,[106] including a grant program of up to $1 billion for public safety agencies. The fund's disbursements were to be administered by the NTIA.[107] At the time, the Congressional Budget Office projected that the grants program for public safety would receive $100 million in FY2007, $370 million in FY2008, $310 million in FY2009 and $220 million in FY2010.[108] However, the 109th Congress, in its closing hours, passed

[102] DHS, National Emergency Communications Plan, July 2008 at http://www.dhs.gov/xlibrary/assets/national_emergency_communications_plan.pdf.

[103] National Emergency Communications Plan, "Executive Summary," page ES-1.

[104] *Ibid.*, "Executive Summary," page ES-2.

[105] P.L. 109-171, Sec. 3002 (a) (1) (B). The deadline was later extended through June 12, 2009 by the DTV Delay Act, P.L. 111-4, Sec. 2 (a) (1).

[106] P.L. 109-171, Sec. 3004, 120 STAT. 22-23.

[107] P.L. 109-171, Sec. 3006, 120 STAT. 24-25.

[108] Congressional Budget Office Cost Estimate, S. 1932, Deficit Reduction Act of 2005, January 27, 2006, p. 21 http://www.cbo.gov/showdoc.cfm?index=7028&sequence=0.

a bill with a provision requiring that the grants program receive "no less than" $1 billion to be awarded "no later than" September 30, 2007.[109] Language in Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53) required some changes in the grant program and reaffirmed the 2007 fiscal year deadline.[110]

In February 2007, the NTIA transferred the management of the public safety grant program to DHS, signing a memorandum of understanding (MOU) with the Office of Grants and Training.[111] The MOU included an overview of how the Public Safety Interoperable Communications (PSIC) Grant Program, as it is called, is to be administered. The overview was reiterated and explained in testimony.[112] Both the MOU and the testimony indicate that the priority was to fund needs identified through Tactical Interoperable Communications Plans and Statewide Interoperable Plans developed in conjunction with SAFECOM.

On July 18, 2007, the Secretaries of Commerce and Homeland Security jointly announced the details of the PSIC grant program.[113] The program, as announced, was to provide $968,385,000 in funding for all 50 states, the District of Columbia, and U.S. Territories.[114] The announcement of the top-level, statewide allocations met the September 30 deadline set by Congress. The states, however, have additional time to submit their detailed requests, and will receive funds through FY2010.[115] The status of the PSIC grant program was discussed at a hearing in March 2009. Testimony at the time indicated that all of the states, territories, and the District of Columbia had filed Statewide Communication Interoperability Plans, a prerequisite for receiving funds.[116]

[109] P.L. 109-459, Sec. 2.

[110] P.L. 110-53, Implementing Recommendations of the 9/11 Commission Act of 2007, Title XXII, Sec. 2201, 121 STAT. 537 *et seq*.

[111] MOU at http://www.ntia.doc.gov/otiahome/psic/PSICMOU_Executed_2-16-2007.pdf.

[112] Testimony of Corey Gruber, Acting Assistant Secretary for Grants and Planning, Office of Grants and Training, Department of Homeland Security at hearing on "Public Safety Interoperable Communications Grants: Are the Departments of Homeland Security and Commerce Effectively Coordinating to Meet our Nation's Emergency Communications Needs?" House of Representatives, Homeland Security Committee, Subcommittee on Emergency Communications, Preparedness, and Response, March 14, 2007.

[113] Press releases at http://www.dhs.gov/xnews/releases/pr_1184783934669.shtm and http://www.ntia.doc.gov/ntiahome/press/2007/PSIC_071807.pdf.

[114] See http://www.dhs.gov/xgovt/grants/gc_1184774852768.shtm. The NTIA website main page has a section devoted to PSIC at http://www.ntia.doc.gov.

[115] For details, see http://www.ntia.doc.gov/psic/awards.html.

[116] Testimony of W. Ross Ashley, III, Assistant Administrator, Grant Programs Directorate, FEMA, Hearing, "Interoperable Communications," House of Representatives, Committee on Appropriations, Subcommittee on Homeland Security, March 17, 2009.

Appendix B. Spectrum Allocation and Assignment for Public Safety Needs

The processes used to manage spectrum start with allocating radio frequency bands for types of use, and then assigning rights to license-holders to transmit on specific radio frequencies within the designated bands. For spectrum designated for public safety, the Federal Communications Commission (FCC) typically gives responsibility for assigning radio channels to frequency coordinators at the regional, state, county, or local level. Federal agencies concerned with public safety have separate allocations managed under the general direction of the National Telecommunications and Information Administration (NTIA). None of the frequencies in the 700 MHz band have been assigned to federal agencies.

Allocating Spectrum for Public Safety

The initial allocation to public safety of frequencies in the 700 MHz band was required by Congress in the Balanced Budget Act of 1997 (P.L. 105-33),[117] which directed the FCC to designate 24 MHz of spectrum capacity for public safety. To carry out the process of assigning this newly allocated spectrum asset, the FCC created the Public Safety National Coordination Committee (NCC) as a Federal Advisory Committee. Active from 1999 through 2003, the NCC had a Steering Committee from government, the public safety community, and the telecommunications industry. The NCC developed technical and operational recommendations for the 700 MHz band, including plans for interoperable channels. The existing governance for these channels is through Regional Planning Committees (RPCs),[118] established and loosely coordinated by the FCC, with the participation of the National Public Safety Telecommunications Council (NPSTC), a group consisting primarily of public safety associations. The RPCs are responsible for submitting 700 MHz band plans to the FCC for approval, and for managing these plans.

Reviewing the Spectrum Needs of Public Safety

In December 2005, the FCC submitted a report to Congress on spectrum needs for emergency response providers, as required by provisions in the Intelligence Reform and Terrorism Prevention Act of 2004 (P.L. 108-458).[119] For the study,[120] the FCC sought comment on whether additional spectrum should be made available to public safety for broadband applications, possibly from the 700 MHz band. Comments received from the public safety community overwhelmingly supported the need for additional spectrum, although other bands besides 700 MHz were also mentioned. The FCC did not make a specific recommendation for additional spectrum allocations in the short-term although it stated that it agreed that public safety "could

[117] 47 U.S.C. § 309 (j) (14).

[118] Additional information at http://www.fcc.gov/pshs/public-safety-spectrum/700-MHz/regional-planning.html.

[119] P.L. 108-458, Title VII, Subtitle D, Sec. 7502, 118 STAT 3855 *et seq*. Enacted December 17, 2004.

[120] Report to Congress on the Study to Assess Short-term and Long-term Needs for Allocations of Additional Portions of the Electromagnetic Spectrum for Federal, State and Local Emergency Response Providers, Federal Communications Commission, December 19, 2005, at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-262865A1.pdf.

make use of such an allocation in the long-term to provide broadband services."[121] It qualified this statement by observing that a spectrum assignment is only one factor in assuring access to mobile broadband services for emergency response. Upon submitting the report to Congress, the FCC announced that it would move expeditiously to determine whether the current band plan for the 24 MHz at 700 MHz designated for public safety could be modified to accommodate broadband applications.[122]

Mandating Spectrum Auctions

During the same time frame that the FCC was reviewing public safety spectrum needs, Congress was drafting the Deficit Reduction Act of 2005 (P.L. 109-171), which became public law on February 8, 2006. In addition to mandating the termination of analog television broadcasting in the 700 MHz band, the law required the FCC to auction all unassigned frequencies in the band. This action precluded the possibility of increasing the amount of spectrum at 700 MHz that could be assigned to public safety.

Creating the D Block

In March 2006, the FCC issued a request for proposals for a new band plan that would designate spectrum for broadband use by first responders within the 24 MHz allocated for public safety.[123] Comments to the FCC led the agency to alter the band plan for public safety and to lay the groundwork for a broadband network that would be built on spectrum resources shared by public safety and a commercial wireless service provider. This decision triggered a series of events that have led to the current impasse, jeopardizing the development of the nationwide, interoperable, robust, modern, and effective public safety communications capability that became a national objective after September 11, 2001.

As part of the preparation for the mandated auction of frequencies at 700 MHz, the FCC, as is its common practice, grouped the frequencies into blocks, wrote rules for their auction, and established service rules laying out requirements for the winning bidders.[124] Rules for one block, designated the Upper Block D, or D Block, provided for sharing between a commercial network and public safety users.[125] A Public Safety Broadband Licensee was designated by the FCC and assigned a single, national license for 10 MHZ, carved from the 24 MHz originally set aside for public safety use. A commercial license with national coverage, also 10 MHz—the D Block—was put up for auction under service rules that required working with the Public Safety Licensee to build and manage a shared network. The costs of building the network were to be borne by the D Block licensee. The two licensees (public safety and commercial) would have been required to negotiate a Network Sharing Agreement, subject to FCC approval. The auction did not yield a winner for the D Block. Restrictive auction rules and uncertainty about how the public-private

[121] *Ibid.*, paragraph 99.

[122] *Ibid.*, paragraph 100.

[123] FCC, *Eighth Notice of Proposed Rule Making*, WT Docket No. 96-86, released March 17, 2006.

[124] Competitive bidding has been the preferred method for assigning commercial spectrum licenses since 1994, when the FCC held its first auction. Background information at http://wireless.fcc.gov/auctions/default.htm?job=about_auctions.

[125] *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, FCC. *Second Report and Order*, Docket No. 06-150, released August 10, 2007 at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-07-132A1.pdf.

partnership would be managed were among the causes cited for the D Block auction failure. The FCC, therefore, began the process of drafting new auction rules for that license.[126] New rules have not been released and a new auction for the D Block has yet to be announced. The FCC opened a new comment period regarding the requests for permission to begin building on some of the frequencies assigned to the Public Safety Broadband Licensee. Subsequently, it asked for comments "to refresh the record" on the broader issues concerning the 700 MHz band.[127] The FCC released a public notice on September 28, 2009,[128] seeking information about current and potential future use of broadband in public safety communications. The notice also seeks comment on costs and networking solutions.

Public-Private Partnership[129]

In extending the scope of its authority to write service rules for auctions,[130] the FCC made a commitment to oversee and adjudicate the operation of a network that, when completed, could have an asset value in the tens of billions of dollars. A large part of that asset might be managed by the Public Safety Broadband Licensee, governed by its Board of Directors in accordance with FCC regulations. In its plans for oversight of the public-private partnership, the FCC announced its intention of enforcing existing rules or creating new rules as circumstances warranted. Measures to enforce the rules would include litigation, revocation of license, or other means that might be supported by a reading of the Communications Act.[131] The role of Congress, in accepting this arrangement, would be to provide guidance to the FCC commissioners through the various means available to it.

Requirements for the Public Safety Broadband Licensee

The public safety licensee would be obligated to meet a number of requirements. These requirements focus mainly on three areas: the formation of a not-for-profit corporation to hold the license; the responsibilities of this non-profit organization—including establishing standards and participating in the creation of the Network Sharing Agreement with a commercial partner; and compliance.

[126] FCC, *Third Notice of Proposed Rulemaking*, PS Docket No. 06-229, September 25, 2008 at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-230A1.pdf.

[127] FCC Public Notice, "Public Safety and Homeland Security Bureau Seeks Comment on Petitions for Waiver to Deploy 700 MHz Public Safety Broadband Networks," August 14, 2009, PS Docket No. 06-229 at http://fjallfoss.fcc.gov/edocs_public/attachmatch/DA-09-1819A1.pdf.

[128] FCC, NBP Public Notice # 8, *Additional Comment Sought on Public Safety, Homeland Security, and Cybersecurity Elements of National Broadband Plan*, DA 09-2133, released September 08, 2009, GN Docket Nos. 09-47, 09-51, 09-137 at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-2133A1.pdf.

[129] A detailed discussion of this topic, covering key events through 2008, appears in CRS Report RL34054, *Public-Private Partnership for a Public Safety Network: Governance and Policy*, by Linda K. Moore.

[130] The FCC has the authority to conduct auctions, set performance requirements, and evaluate the qualifications of licensees, 47 U.S.C. § 309 (j), especially, (3), (4) and (5).

[131] The FCC seemed to presume private equity or hedge fund ownership of the D Block companies as it does not mention how it would use the Communications Act to protect the interests of shareholders in a publicly traded company.

Selection and Establishment of the Public Safety Broadband Licensee

The FCC selected the Public Safety Broadband Licensee based on criteria such as not-for-profit corporate status; absence of commercial interests, either in the holding of the license or its management; and broad representation of public safety entities. In anticipation of receiving the public safety license, a group of public safety associations formed the Public Safety Spectrum Trust Corporation (PSST). The Trust hired Cyren Call Communications Corporation to act as its advisor and liaison in negotiating with the D Block licensee. The PSST was subsequently awarded the nationwide Public Safety Broadband License.[132]

Board of Directors

Representation on the Board of Directors of the Public Safety Broadband Licensee consists of members from named organizations representing public safety. In the *Second Report and Order*, the FCC provided a list of 11 organizations designated to appoint board members and allowed for two at-large members, creating a board of 13 members.[133] In a later *Order on Reconsideration*,[134] the FCC changed the composition of the board, adding three representatives from named organizations, eliminating one representative, and increasing the number of at-large members from two to four.[135] Four at-large members were subsequently selected jointly by the FCC bureaus for Public Safety and Homeland Security and for Wireless Telecommunications.[136] The FCC chose to eliminate the National Public Safety Telecommunications Council (NPSTC) as a named member of the board because of the overlap of its membership with the composition of the associations that were given permanent status on the board.[137]

[132] FCC, *Order*, November 19, 2007, PS Docket No. 06-299.

[133] *Second Report and Order*, paragraph 374.

[134] FCC, *Order on Reconsideration*, September 24, 2007, WT Docket No. 96-86.

[135] The board consists of representatives for: the Association of Public-Safety Communications Officials - International (APCO), the National Emergency Number Association (NENA), the International Association of Fire Chiefs (IAFC), the International Association of Chiefs of Police (IACP), the International City/County Management Association (ICMA); the National Governors Association (NGA); the National Association of State EMS Officials (NASEMSO); the Forestry Conservation Communications Association (FCCA); the American Association of State Highway and Transportation Officials (AASHTO); the International Municipal Signal Association (IMSA), the American Hospital Association (AHA), the National Fraternal Order of Police (NFOP), the National Association of State 9-1-1 Administrators (NASNA), the National Emergency Management Association (NEMA) and the National Sheriffs' Association (NSA), http://www.psst.org/boardmembers.jsp.

[136] FCC, *Public Notice*, "Public Safety and Homeland Security Bureau and Wireless Telecommunications Bureau Announce the Four At-Large Members of the Public Safety Broadband Licensee's Board of Directors," November 9, 2007, DA 07-4593.

[137] *Order on Reconsideration*, paragraph 5. NPSTC membership includes a governing board with representation from these associations that are to be represented on the board of the public safety licensee organization: AASHTO, APCO, FCCA, IACP, and IMSA. The NPSTC board is advised by liaison organizations that include, the FCC, the NTIA, FEMA, DHS offices of Emergency Communications and of Interoperability and Compatibility, SAFECOM (also from DHS), the departments of Agriculture, the Interior, and Justice, and the Telecommunications Industry Association (TIA). For more information on membership and organizational structure, see http://www.npstc.org/orgchart.jsp.

Oversight

As part of the FCC's oversight, PSST, as selected licensee, would be required to file quarterly financial reports with the FCC, with copies to the chiefs of the Public Safety and Homeland Security Bureau and the Wireless Telecommunications Bureau.[138] This requirement would take effect after the NSA had been negotiated. The licensee must meet criteria for its articles of incorporation and bylaws, as specified in the *Second Report and Order* rules.[139] The FCC has judged that it is appropriate for the FCC to provide, as needed, "extensive" oversight to ensure that these corporate governance stipulations would be met.[140]

Obligations of the Public Safety Licensee

The selected public safety licensee, having met the initial requirements for qualification, would have additional tasks set for it by the FCC. General responsibilities would include:[141]

- Negotiate a Network Sharing Agreement with its commercial partner, the qualifying, winning bidder for the D Block.
- Administer access to the network for public safety users, including assessment of usage fees.
- Represent the interests of its public safety constituents that use the network.
- Negotiate purchase agreements with vendors that provide savings through economies of scale, or other benefits. This responsibility does not limit the licensee's right to determine and approve equipment specifications.
- Approve, in consultation with D Block licensee, the equipment and applications that may be used on the network. The licensee has the sole authority to determine the acceptability of equipment or applications. State and local entities must seek approval from the licensee before linking their systems or equipment to the broadband network.
- Coordinate stations accessing narrowband and broadband frequencies.
- Oversee and implement the relocation of some users required by rebanding of parts of the 700 MHz band.

The Public Safety Spectrum Trust was created in response to requirements set out by the FCC. Most of the proposals for a government-controlled network assume a continued role for the PSST with responsibilities similar to those proposed by the FCC. The FCC would probably maintain its oversight role of the PSST.

[138] *Second Report and Order*, paragraph 377.

[139] *Ibid.*, paragraph 375.

[140] *Ibid.*, paragraph 376.

[141] *Ibid.*, paragraph 383, and *Third Report and Order*, paragraphs 175-176.

Funding

As envisioned by the FCC, the cost of building the national network using the spectrum held by the broadband licensee would be shouldered by its commercial partner, although there could be system enhancements or other components funded by the public sector. As proposed by PSST's advisor, Cyren Call Communications Corporation, the PSST would have borrowed $197 million secured by projected revenue from its D Block partner in spectrum access fees.[142] This sum was for capital expenditures, such as building an overlay for network administration, and did not include operating costs. In its *Third Report and Order* the FCC proposed that the D Block owner pay the PSBL up to $5 million a year to cover expenses incurred in managing the license, network sharing agreement, and other administrative duties.[143] It set up new requirements that would prevent potential conflicts of interest and prevent the PSBL from acquiring debt or equity financing from any source.[144]

[142] CRS meeting with Cyren Call executives, March 13, 2008.

[143] *Third Report and Order*, paragraph 374.

[144] *Ibid.*, paragraphs 351-352.

Appendix C. Requests to Build Regional Networks in Advance of the Assignment of the D Block

The Federal Communications Commission (FCC) has asked for comments on petitions for permission to build independent broadband networks using spectrum currently assigned to the Public Safety Broadband Licensee (PSBL).[145] Preliminary FCC plans were for the PSBL to partner with the commercial owner of the D Block to build a single network for shared use between public safety and commercial users. Until the D Block is assigned, plans for the envisioned network remain incomplete. Some of the requestors have noted the small window of opportunity to apply for stimulus funds that might be used for building their own regional networks. The following petitions are listed in the FCC notice, other states and localities have filed petitions since publication of the notice.

- City of Boston, Massachusetts.
- City and County of San Francisco, City of Oakland, and the City of San Jose, California (Bay Area Petition).
- State of New Jersey.
- City of New York.
- New York State.
- District of Columbia.
- City of Chesapeake, Virginia.
- City of San Antonio, Texas.
- State of New Mexico.
- State of North Dakota and New EA, Inc. dba Flow Mobile.
- City of Charlotte, North Carolina.
- Counties of Blackhawk, Buchanan, Dubuque, Grundy, Johnson, Marshall, and Scott, and the City of Cedar Rapids, Iowa.

[145] As reported in FCC Public Notice, "Public Safety and Homeland Security Bureau Seeks Comment on Petitions for Waiver to Deploy 700 MHz Public Safety Broadband Networks," August 14, 2009, PS Docket No. 06-229 at http://fjallfoss.fcc.gov/edocs_public/attachmatch/DA-09-1819A1.pdf.

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