

**GAO**

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Science, and Transportation  
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**TELECOMMUNICATIONS**

**Options for and Barriers to  
Spectrum Reform**

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Physical Infrastructure Issues





Highlights of [GAO-06-526T](#), testimony before the Committee on Commerce, Science, and Transportation, United States Senate

## Why GAO Did This Study

The radio-frequency spectrum is used to provide an array of wireless communications services that are critical to the U.S. economy and various government missions, such as national security. With demand for spectrum exploding, and most useable spectrum allocated to existing users, there is growing concern that the current spectrum management framework might not be able to respond adequately to future demands. This testimony, which is based on previous GAO reports, provides information on (1) the extent to which the Federal Communications Commission (FCC) has adopted market-based mechanisms for commercial use, (2) the extent to which market-based mechanisms have been adopted for federal government users of spectrum, (3) options for improving spectrum management, and (4) potential barriers to spectrum reform.

## What GAO Recommends

In previous reports, GAO recommended that (1) the Secretary of Commerce and FCC should jointly develop a national spectrum plan to guide decision making, and (2) the relevant administrative agencies and congressional committees work together to develop and implement a plan for the establishment of an independent commission that would conduct a comprehensive examination of current spectrum management. To date, these recommendations have not been implemented.

[www.gao.gov/cgi-bin/getrpt?GAO-06-526T](http://www.gao.gov/cgi-bin/getrpt?GAO-06-526T).

To view the full product, including the scope and methodology, click on the link above. For more information, contact JayEtta Z. Hecker at (202) 512-2834 or [heckerj@gao.gov](mailto:heckerj@gao.gov).

# TELECOMMUNICATIONS

## Options for and Barriers to Spectrum Reform

### What GAO Found

FCC is incrementally adopting market-based approaches for managing the commercial use of spectrum. Market-based mechanisms can help promote the efficient use of spectrum by invoking the forces of supply and demand. For example, although FCC currently employs largely a command-and-control process for spectrum allocation, it has provided greater flexibility within certain spectrum bands. In addition, FCC began using auctions to assign spectrum licenses for commercial uses in 1994. Finally, FCC has taken steps to facilitate greater secondary market activity, which may provide an additional mechanism to promote the efficient use of spectrum.

While some countries have adopted market-based mechanisms to encourage the efficient use of spectrum by government agencies, the Department of Commerce's National Telecommunications and Information Administration (NTIA) has not adopted similar mechanisms for federal government use in the United States. NTIA imposes fees designed to recover only a portion of its cost to administer spectrum management, rather than fees that would more closely resemble market prices and thus encourage greater spectrum efficiency among government users; currently, NTIA does not have authority to impose fees that exceed its spectrum management costs. However, adopting market-based mechanisms for federal government use of spectrum might be difficult or undesirable in some contexts because of the primacy of certain government missions, the lack of flexibility in use of spectrum for some agencies, and the lack of financial incentives for government users.

Industry stakeholders and experts have identified a number of options for improving spectrum management. The most frequently cited options include (1) extending FCC's auction authority, (2) reexamining the use and distribution of spectrum, and (3) ensuring clearly defined rights and flexibility in commercial spectrum bands; there was no consensus on these options, except for extending FCC's auction authority. Given the success of FCC's use of auctions and the overwhelming support for extending FCC's auction authority, GAO suggested that the Congress consider extending FCC's auction authority beyond 2007. Congress extended FCC's auction authority to 2011 with the passage of the Deficit Reduction Act of 2005.

The current spectrum management framework may pose barriers to reform, since neither FCC nor NTIA has been given ultimate decision-making authority over all spectrum use, or the authority to impose fundamental reform, such as increasing the reliance on market-based mechanisms. Under the divided management framework, FCC manages spectrum for nonfederal users, including commercial uses, while NTIA manages spectrum for federal government users. As such, FCC and NTIA have different perspectives on spectrum use. Further, spectrum management issues and major reform cross the jurisdictions of both agencies. Thus, contentious and protracted negotiations arise over spectrum management issues.

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Mr. Chairman and Members of the Committee:

We appreciate the opportunity to provide testimony on spectrum reform issues. As you know, the radio-frequency spectrum is used to provide an array of wireless communications services that are critical to the U.S. economy and various government missions, such as national security. Demand for radio-frequency spectrum has exploded over the past several decades as new technologies and services have been—and continue to be—brought to the market in the private sector, and new mission needs unfold among government users. As a result, nearly all parties are becoming increasingly concerned about the availability of spectrum for future needs because most of the usable spectrum in the United States has already been allocated to existing services and users. Compounding this concern is evidence that some of the spectrum is currently underutilized. Many parties believe that spectrum management reform—such as greater reliance on market-based mechanisms that invoke the forces of demand and supply—is essential to meeting the growing and unpredictable demand for spectrum.

My statement today will identify (1) the extent to which the Federal Communications Commission (FCC) has adopted market-based mechanisms for commercial uses of spectrum,<sup>1</sup> (2) the extent to which market-based mechanisms have been adopted for federal government use of spectrum, (3) options for improving spectrum management, and (4) potential barriers to spectrum reform. My comments are based on our body of work on spectrum management, including our recently issued report to this Committee;<sup>2</sup> these reports were prepared in accordance with generally accepted government auditing standards.

In summary:

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<sup>1</sup>FCC manages spectrum use for nonfederal users, including commercial, private, and state and local government users.

<sup>2</sup>GAO, *Telecommunications: Strong Support for Extending FCC's Auction Authority Exists, but Little Agreement on Other Options to Improve Efficient Use of Spectrum*, [GAO-06-236](#) (Washington, D.C.: Dec. 20, 2005); GAO, *Telecommunications: Comprehensive Review of U.S. Spectrum Management with Broad Stakeholder Involvement is Needed*, [GAO-03-277](#) (Washington, D.C.: Jan. 31, 2003); and GAO, *Telecommunications: Better Coordination and Enhanced Accountability Needed to Improve Spectrum Management*, [GAO-02-906](#) (Washington, D.C.: Sept. 30, 2002).

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- FCC is incrementally adopting market-based approaches to managing the commercial use of spectrum. Market-based mechanisms can help promote the efficient use of spectrum by invoking the forces of supply and demand—that is, they provide users an incentive to use the spectrum as efficiently as possible. Examples of market-based mechanisms include introducing flexibility in the use of spectrum, using auctions to assign licenses, and enhancing the use of secondary markets as a means for companies to obtain access to spectrum. FCC has adopted these mechanisms for commercial uses. For example, although FCC currently employs largely a command-and-control process for spectrum allocation, it has provided greater flexibility within certain spectrum bands. In addition, FCC began using auctions to assign spectrum licenses for commercial uses in 1994. According to industry stakeholders, FCC’s implementation of auctions is seen as an improvement over comparative hearings and lotteries, the primary assignment mechanisms employed in the past. Finally, FCC has taken steps to facilitate greater secondary market activity, which may provide an additional mechanism to promote the efficient use of spectrum.
  - While some countries have adopted market-based mechanisms to encourage the efficient use of spectrum by government agencies, the Department of Commerce’s National Telecommunications and Information Administration (NTIA) has not adopted similar mechanisms for federal government use in the United States. NTIA imposes fees that recover only a portion of its cost to administer spectrum management, rather than incentive-based fees—that is, fees that more closely resemble market prices and thus encourage greater spectrum efficiency among government users; currently, NTIA does not have authority to impose fees that exceed its spectrum management costs. However, adopting market-based mechanisms for federal government use of spectrum might be difficult or undesirable in some contexts because of the primacy of certain government missions, the lack of flexibility in use of spectrum for some agencies, and the lack of financial incentives for government users.
  - As we reported in December 2005, industry stakeholders and experts have identified a number of options for improving spectrum management. The most frequently cited options include (1) extending FCC’s auction authority, (2) reexamining the use and distribution of spectrum, and (3) ensuring clearly defined rights and flexibility in commercially licensed spectrum bands; there was no consensus on these options, except for extending FCC’s auction authority. Given the success of FCC’s use of auctions and the overwhelming support for extending FCC’s auction authority, we suggested that the Congress consider extending FCC’s auction authority beyond the 2007 expiration date. Congress extended

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FCC's auction authority to 2011 with the passage of the Deficit Reduction Act of 2005.<sup>3</sup>

- The current management framework may pose barriers to reform since, while two agencies have been given responsibility for aspects of spectrum management, neither has been given ultimate decision-making authority over all spectrum use or the authority to impose fundamental reform, such as increasing the reliance on market-based mechanisms. Under this divided management framework, FCC manages spectrum for nonfederal users while NTIA manages spectrum for federal government users. However, spectrum management issues and major reform cross the jurisdictions of both agencies. To address these barriers, we have previously recommended that (1) the Secretary of Commerce and FCC establish and carry out formal, joint planning activities to develop a national spectrum plan to guide decision making; and (2) the relevant administrative agencies and congressional committees work together to develop and implement a plan for the establishment of a commission that would conduct a comprehensive examination of current spectrum management.<sup>4</sup> To date, these recommendations have not been implemented.

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## Background

The radio-frequency spectrum is the part of the natural spectrum of electromagnetic radiation lying between the frequency limits of 9 kilohertz and 300 gigahertz.<sup>5</sup> It is the medium that makes wireless communications possible and supports a vast array of commercial and governmental services. Commercial entities use spectrum to provide a variety of wireless services, including mobile voice and data, paging, broadcast radio and television, and satellite services. Additionally, some companies use spectrum for private tasks, such as communicating with remote vehicles. Federal, state, and local agencies also use spectrum to fulfill a variety of government missions. For example, state and local police departments, fire departments, and other emergency services agencies use spectrum to transmit and receive critical voice and data communications, and federal

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<sup>3</sup>Pub. L. No. 109-171, §3003, 120 Stat. 4 (2006).

<sup>4</sup>[GAO-02-906](#) and [GAO-03-277](#).

<sup>5</sup>Radio signals travel through space in the form of waves. These waves vary in length, and each wavelength is associated with a particular radio frequency. Radio frequencies are grouped into bands and are measured in units of Hertz. The term kilohertz refers to thousands of Hertz, megahertz (MHz) to millions of Hertz, and gigahertz to billions of Hertz.

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agencies use spectrum for varied mission needs such as national defense, law enforcement, weather services, and aviation communication.

Spectrum is managed at the international and national levels. The International Telecommunication Union (ITU), a specialized agency of the United Nations, coordinates spectrum management decisions among nations. Spectrum management decisions generally require international coordination, since radio waves can cross national borders. Once spectrum management decisions are made at the ITU, regulators within each nation, to varying degrees, will follow the ITU decisions. In the United States, responsibility for spectrum management is divided between two agencies: FCC and NTIA. FCC manages spectrum use for nonfederal users, including commercial, private, and state and local government users under authority provided in the Communications Act. NTIA manages spectrum for federal government users and acts for the President with respect to spectrum management issues.<sup>6</sup> FCC and NTIA, with direction from the Congress, jointly determine the amount of spectrum allocated to federal and nonfederal users, including the amount allocated to shared use.

Historically, concern about interference or crowding among users has been a driving force in the management of spectrum.<sup>7</sup> FCC and NTIA work to minimize interference through two primary spectrum management functions—the “allocation” and the “assignment” of radio spectrum. Specifically:

- **Allocation** involves segmenting the radio spectrum into bands of frequencies that are designated for use by particular types of radio services or classes of users. For example, the frequency bands between 88 and 108 megahertz (MHz) are allocated to FM radio broadcasting in the United States. In addition to allocation, FCC and NTIA also specify service rules, which include the technical and operating characteristics of equipment.
- **Assignment**, which occurs after spectrum has been allocated for particular types of services or classes of users, involves providing a license

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<sup>6</sup>The Department of State also plays a role in spectrum management by coordinating and mediating the U.S. position and leading the nation’s delegation to international conferences on spectrum management.

<sup>7</sup>Interference occurs when two or more radio signals interact in a manner that disrupts the transmission and reception of messages.

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or authorization to use a specific portion of spectrum to users, such as commercial entities or government agencies. FCC assigns licenses for frequency bands to commercial enterprises, state and local governments, and other entities, while NTIA makes frequency assignments to federal agencies.

When FCC assigns a portion of spectrum to a single entity, the license is considered exclusive. When two or more entities apply for the same exclusive license, FCC classifies these as mutually exclusive applications—that is, the grant of a license to one entity would preclude the grant to one or more other entities. For mutually exclusive applications, FCC has primarily used three assignment mechanisms—comparative hearings, lotteries, and auctions. FCC historically used comparative hearings, which gave competing applicants a quasi-judicial forum in which to argue why they should be awarded a license instead of other applicants. In 1981, partially in response to the administrative burden of the comparative hearing process, the Congress authorized the use of lotteries, which allowed FCC to randomly select licenses from the qualified applicant pool.<sup>8</sup> The Congress provided FCC with authority to use auctions to assign mutually exclusive licenses for certain subscriber-based wireless services in the Omnibus Budget Reconciliation Act of 1993.<sup>9</sup> Auctions are a market-based mechanism in which FCC assigns a license to the entity that submits the highest bid for specific bands of spectrum. As of November 30, 2005, FCC has conducted 59 auctions for over 56,000 licenses to select between competing applications for the same license, which have generated over \$14.5 billion for the U.S. Treasury. However, only a very small portion of total licenses has been auctioned. (See fig. 1.)

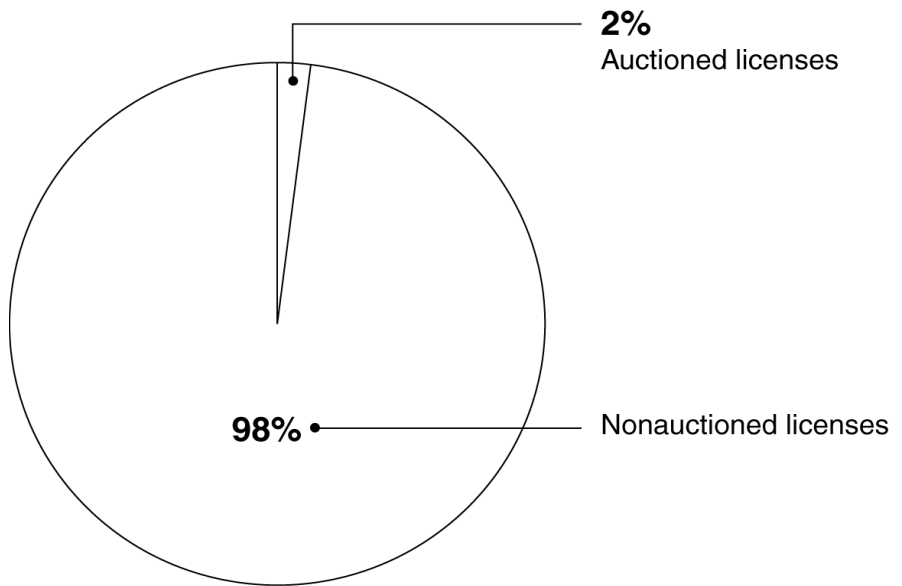
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<sup>8</sup>In 1981, Congress added Section 309(i) to the Communications Act to give FCC the authority to assign a broad range of licenses by lottery. The Balanced Budget Act of 1997, Pub. L. No. 105-33, 111 Stat. 260, tit. III, § 3002, terminated FCC's authority to assign licenses by lotteries, except with respect to licenses for non-commercial broadcast stations and public broadcast stations. See, 47 U.S.C. § 309(i)(5) and 47 U.S.C. § 397(6).

<sup>9</sup>47 U.S.C. § 309(j). In subsequent years, the Congress has modified and extended FCC's auction authority, including exempting some licenses from competitive bidding, such as licenses for public safety radio services and noncommercial educational broadcast services.

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**Figure 1: Percent of Licenses Auctioned**



Source: GAO analysis of FCC data.

Notes:

To calculate the percentage of licenses that have been auctioned, we divided the number of auctioned licenses by the number of licenses included in FCC's three spectrum license databases.

Licenses can vary considerably in terms of bandwidth, as well as the geographic area and population covered.

In some frequency bands, FCC authorizes unlicensed use of spectrum—that is, users do not need to obtain a license to use the spectrum.<sup>10</sup> Rather, an unlimited number of unlicensed users can share frequencies on a non-interference basis. Thus, the assignment process does not apply to the use of unlicensed devices. However, manufacturers of unlicensed equipment must receive authorization from FCC before operating or marketing an unlicensed device.

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<sup>10</sup>Traditional unlicensed devices are low-powered equipment that operate in a limited geographic range, such as cordless phones, baby monitors, garage door openers, and wireless access to the Internet.



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## FCC Has Adopted Several Market-Based Mechanisms for Commercial Uses

To promote the more efficient use of spectrum, FCC is incrementally adopting market-based approaches to spectrum management. For instance, FCC has introduced some flexibility in the spectrum allocation process, although it remains largely a command-and-control process. In addition, in 1994, FCC instituted auctions to assign certain spectrum licenses. According to industry stakeholders, FCC's use of auctions is seen as an improvement over comparative hearings and lotteries, the primary assignment mechanisms employed in the past. Finally, FCC has taken steps to facilitate greater secondary market activity, which may provide an additional mechanism to promote the more efficient use of spectrum.

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## FCC Has Introduced Some Flexibility in the Spectrum Allocation Process but Allocation Remains Largely a Command-and-Control Process

FCC currently employs largely a command-and-control process for spectrum allocation.<sup>11</sup> That is, FCC applies regulatory judgments to determine and limit what types of services—such as broadcast, satellite, or mobile radio—will be offered in different frequency bands by geographic area. In addition, for most frequency bands FCC allocates, the agency issues service rules to define the terms and conditions for spectrum use within the given bands. These rules typically specify eligibility standards as well as limitations on the services that relevant entities may offer and the technologies and power levels they may use. These decisions can constrain users' ability to offer services and equipment of their choosing.

However, FCC has provided greater operational and technical flexibility within certain frequency bands. For example, FCC's rules for Commercial Mobile Radio Service (CMRS), which include cellular and Personal Communications Services (PCS), are considered less restrictive. Under these rules, wireless telephony operators are free to select technologies, services, and business models of their choosing. FCC has not provided comparable flexibility in other bands.<sup>12</sup> For example, spectrum users have relatively little latitude for making similar choices in frequency bands allocated to broadcast television services.

Further, the Spectrum Policy Task Force Report, a document produced by FCC staff, identified two alternatives to the command-and-control model: the "exclusive, flexible rights" model, and the "open-access" model.<sup>13</sup> The

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<sup>11</sup>NTIA employs a similar process for federal government spectrum users.

<sup>12</sup>In some instances, statutory restrictions are an impediment to granting greater flexibility.

<sup>13</sup>For more information on these alternative spectrum management models, including the perceived advantages and disadvantages of each, see [GAO-06-236](#).

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exclusive, flexible rights model provides licensees with exclusive, flexible use of the spectrum and transferable rights within defined geographic areas. This is a licensed-based approach to spectrum management that extends the existing allocation process by providing greater flexibility regarding the use of spectrum, and the ability to transfer licenses or to lease spectrum usage rights. The open-access model allows a potentially unlimited number of unlicensed users to share frequency bands, with usage rights governed by technical standards, but with no rights to interference protection. This approach does not require licenses, and as such is similar to FCC's Part 15 rules (which govern unlicensed use in the 900 MHz, 2.4 GHz, and 5.8 GHz bands)—where cordless phones and Wi-Fi technologies operate. Both models allow flexible use of spectrum, so that users of spectrum, rather than FCC, play a larger role in determining how spectrum is ultimately used. FCC's Spectrum Policy Task Force recommended a balanced approach to allocation—utilizing aspects of the command-and-control; exclusive, flexible rights; and open-access models. FCC is currently using elements of these two alternatives models, although it primarily employs the command-and-control model.

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### FCC's Use of Auctions for Commercial Licenses Is Seen as an Improvement Over Past Assignment Mechanisms

In 1994, FCC began using auctions—a market-based mechanism that assigns a license to the entity that submits the highest bid for specific bands of spectrum. FCC's implementation of auctions mitigates a number of problems associated with comparative hearings and lotteries—the two primary assignment mechanism employed until 1993. For example:

- Auctions are a relatively quick assignment mechanism. With auctions, FCC reduced the average time for granting a license to less than 1 year from the initial application date, compared to an average time of over 18 months with comparative hearings.
- Auctions are administratively less costly than comparative hearings. Entities seeking a license can reduce expenditures for engineers and lawyers arising from preparing applications, litigating, and lobbying; and FCC can reduce expenditures associated with reviewing and analyzing applications.
- Auctions are a transparent process. FCC awards licenses to entities submitting the highest bid rather than relying on possibly vague criteria, as was done in comparative hearings.

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- Auctions are effective in assigning licenses to entities that value them the most. Alternatively, with lotteries, FCC awarded licenses to randomly-selected entities.
  - Auctions are an effective mechanism for the public to realize a portion of the value of a national resource used for commercial purposes. Entities submitting winning bids must remit the amount of their winning bid to the government, which represents a portion of the value that the bidder believes will arise from using the spectrum.

As we reported in December 2005, many industry stakeholders we contacted, and panelists on our expert panel, stated that auctions are more efficient than previous mechanisms used to assign spectrum licenses.<sup>14</sup> For example, among our panelists, 11 of 17 reported that auctions provide the most efficient method of assigning licenses; no panelist reported that comparative hearings or lotteries provided the most efficient method. Of the remaining panelists, several suggested that the most efficient mechanism depended on the service that would be permitted with the spectrum.<sup>15</sup>

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## FCC Has Acted to Facilitate Secondary Market Transactions

While FCC's initial assignment mechanisms provide one means for companies to acquire licenses, companies can also acquire licenses or access to spectrum through secondary market transactions. Through secondary markets, companies can engage in transactions whereby a license or use of spectrum is transferred from one company to another. These transactions can incorporate the sale or trading of licenses. In some instances, companies acquire licenses through the purchase of an entire company, such as Cingular's purchase of AT&T Wireless. Ultimately, FCC must approve transactions that result in the transfer of licenses from one company to another.

Secondary markets can provide several benefits. First, secondary markets can promote more efficient use of spectrum. If existing licensees are not

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<sup>14</sup>See [GAO-06-236](#). We convened, in collaboration with the National Academies, two panels of experts to discuss spectrum allocation and assignment issues and options to improve spectrum management. The panelists convened at the National Academies on August 9, 2005, and August, 10, 2005. A total of 23 panelists participated on our two expert panels. For more information on the expert panels, see [GAO-06-236](#).

<sup>15</sup>For example, some panelists did not support using auctions to assign spectrum licenses for public safety services.

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fully utilizing the spectrum, secondary markets provide a mechanism whereby these licensees can transfer use of the spectrum to other companies that would utilize the spectrum. Second, secondary markets can facilitate the participation of small businesses and introduction of new technologies. For example, a company might have a greater incentive to deploy new technologies that require less spectrum if the company can profitably transfer the unused portion of the spectrum to another company through the secondary market. Also, several stakeholders with whom we spoke noted that secondary markets provide a mechanism whereby a small business can acquire spectrum for a geographic area that best meets the needs of the company.

In recent years, FCC has undertaken actions to facilitate secondary-market transactions. FCC authorized spectrum leasing for most wireless radio licenses with exclusive rights and created two categories of spectrum leases: Spectrum Manager Leasing—where the licensee retains legal and working control of the spectrum—and de Facto Transfer Leasing—where the licensee retains legal control but the lessee assumes working control of the spectrum. FCC also streamlined the procedures that pertain to spectrum leasing. For instance, the Spectrum Manager Leases do not require prior FCC approval and de Facto Transfer Leases can receive immediate approval if the arrangement does not raise potential public interest concerns.<sup>16</sup> While FCC has taken steps to facilitate secondary market transactions, some hindrances remain. For example, some industry stakeholders told us that the lack of flexibility in the use of spectrum can hinder secondary market transactions.

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<sup>16</sup>The public interest concerns arise as a result of FCC policies pertaining to (1) eligibility and use of the license and spectrum, (2) foreign ownership limitations, (3) designated entity and entrepreneur benefits, and (4) competition. See *Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, WT Docket No. 00-230, Second Report and Order, Order on Reconsideration, and Second Further Notice of Proposed Rulemaking, 19 FCC Rcd. 17503 (2004).

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## Market-Based Mechanisms Have Not Been Adopted for Federal Government Use of Spectrum

In some countries, spectrum managers have adopted market-based mechanisms to encourage the efficient use of spectrum by government agencies. In the United States, NTIA has not adopted incentive-based fees for federal government users of spectrum; rather, NTIA applies fees that recover only a portion of the cost of administering spectrum management. Additionally, adopting market-based mechanisms for government use of spectrum might be difficult or undesirable in some contexts because of the primacy of certain government missions, the lack of flexibility in use of spectrum for some agencies, and the lack of financial incentives for government users.

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## Incentive-Based Fees Have Not Been Used to Promote Spectrum Efficiency Among Federal Government Users of Spectrum in the United States

Spectrum managers in some countries have adopted market-based mechanisms for government users of spectrum. For example, in Australia, Canada, and the United Kingdom, spectrum managers have implemented incentive-based fees for government users of spectrum. Incentive-based fees are designed to promote the efficient use of spectrum by compelling spectrum users to recognize the value to society of the spectrum that they use. In other words, these fees mimic the functions of a market. These incentive-based fees differ from other regulatory fees that are assessed only to recover the cost of the government's management of spectrum.

In the United States, NTIA has not adopted incentive-based fees, or other market-based mechanisms, for federal government users of spectrum. Currently, NTIA charges federal agencies spectrum management fees, which are based on the number of assignments authorized to each agency. In our 2002 report, we noted that, according to NTIA, basing the fee on the number of assignments, rather than the amount of spectrum used per agency, better reflects the amount of work NTIA must do for each agency.<sup>17</sup> Moreover, NTIA stated that this fee structure provides a wider distribution of costs to agencies. However, NTIA's fee does not reflect the value of the spectrum authorized to each agency, and thus it is not clear how much this encourages the efficient use of spectrum by federal agencies. The fee also recovers only a portion of the cost of administering spectrum management. NTIA does not currently have the authority to

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<sup>17</sup>[GAO-02-906](#).

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impose fees on government users that exceed its spectrum management costs.<sup>18</sup>

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## Applying Market-Based Mechanisms to Federal Government Users May Not Be Effective in All Contexts

Applying market-based mechanisms might be difficult or undesirable for federal government users in some situations. The purpose of market-based mechanisms is to provide users with an incentive to use spectrum as efficiently as possible. However, the characteristics of government use of spectrum impose challenges to the development and implementation of market-based mechanisms for federal government users, and in some situations, make implementation undesirable. For example:

- **Primacy of certain federal government missions.** Because of the primacy of certain federal government missions—such as national defense, homeland security, and public safety—imposition of market-based mechanisms for use of the spectrum to fulfill these missions might not be desirable. In fact, NTIA officials have told us that the agency rarely revokes the spectrum authorization of another government agency because doing so could interfere with the agency’s ability to carry out important missions.
- **Lack of flexibility in use of spectrum.** Market-based mechanisms can create an incentive to use spectrum more efficiently only if users can actually choose to undertake an alternative means of providing a service. In some situations, federal government agencies do not have a viable alternative to their current spectrum authorization. For example, spectrum used for air traffic control has been allocated internationally for the benefit of international air travel. Thus, the Federal Aviation Administration has little ability to use spectrum differently than prescribed in its current authorizations. In situations such as this, market-based mechanisms would likely prove ineffective.
- **Lack of financial incentives.** If federal government users can obtain any needed funding for spectrum-related fees through the budgetary process, market-based mechanisms are not likely to be effective. However, imposing fees will make the cost visible to agency managers, thus

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<sup>18</sup>In its 2005 program assessment of NTIA, OMB noted that NTIA does not currently have sufficient mechanisms in place to ensure efficient and effective federal spectrum use. OMB further notes that NTIA lacks the authority to implement market-based or other incentives to promote efficient and effective use of the federal spectrum among federal agencies. According to OMB, NTIA plans to study incentives to promote the more efficient and effective use of spectrum and seek authority to implement incentives, as appropriate.

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providing them information they need if they are to manage spectrum use more efficiently. Whether more efficient spectrum use actually occurs will depend in part on whether agencies receive appropriations for the full amount of the fees or only for some portion. If agencies do not receive appropriations for the full amount, some pressure will be created, but it will not be as strong as the private sector's profit motive.

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## Industry Stakeholders and Panelists Suggested Several Options to Improve Spectrum Management

As we reported in December 2005, industry stakeholders and panelists on our expert panel offered a number of options for improving spectrum management.<sup>19</sup> The most frequently cited options include (1) extending FCC's auction authority, (2) reexamining the distribution of spectrum—such as between commercial and government use—to enhance the efficient and effective use of this important resource, and (3) ensuring clearly defined rights and flexibility in commercially licensed spectrum bands. There was no consensus on these options for improvements among stakeholders we interviewed and panelists on our expert panel, except for extending FCC's auction authority.

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## Extend FCC's Auction Authority

Panelists on our expert panel and industry stakeholders with whom we spoke overwhelmingly supported extending FCC's auction authority. For example, 21 of 22 panelists on our expert panel indicated that the Congress should extend FCC's auction authority beyond September 2007—the date auction authority was set to expire at the time of our expert panel. Given the success of FCC's use of auctions and the overwhelming support among industry stakeholders and experts for extending FCC's auction authority, we suggested that the Congress consider extending FCC's auction authority. In February 2006, the Congress extended FCC's auction authority to 2011 with the passage of the Deficit Reduction Act of 2005.<sup>20</sup>

While panelists on our expert panel overwhelmingly supported extending FCC's auction authority, a majority also suggested modifications to enhance the use of auctions.<sup>21</sup> However, there was little consensus on the

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<sup>19</sup>GAO-06-236.

<sup>20</sup>Pub. L. No. 109-171.

<sup>21</sup>Fifteen of twenty-two panelists suggested modifications to enhance the use of auctions.

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suggested modifications. The suggested modifications fall into the following three categories:

- **Better define license rights.** Some industry stakeholders and panelists indicated that FCC should better define the rights accompanying spectrum licenses, as these rights can significantly affect the value of a license being auctioned. For example, some industry stakeholders expressed concern with FCC assigning overlay and underlay rights to frequency bands when a company holds a license for the same frequency bands.<sup>22</sup>
- **Enhance secondary markets.** Industry stakeholders we contacted and panelists on our expert panel generally believed that modifying the rules governing secondary markets could lead to more efficient use of spectrum. For example, some panelists on our expert panel said that FCC should increase its involvement in the secondary market. These panelists thought that increased oversight could help to both ensure transparency in the secondary market and also promote the use of the secondary market. Additionally, a few panelists said that adoption of a “two-sided” auction would support the efficient use of spectrum. With a two-sided auction, FCC would offer unassigned spectrum, and existing licensees could make available the spectrum usage rights they currently hold.
- **Reexamine existing small business incentives.** The opinions of panelists on our expert panel and industry stakeholders with whom we spoke varied greatly regarding the need for and success of FCC’s efforts to promote economic opportunities for small businesses. For example, some panelists and industry stakeholders do not support incentive programs for small businesses. These panelists and industry stakeholders cited several reasons for not supporting these incentives, including (1) the wireless industry is not a small business industry; (2) while the policy may have been well intended, the current program is flawed; or (3) such incentives create inefficiencies in the market. Other industry stakeholders suggested alternative programs to support small businesses. These suggestions included (1) having licenses cover smaller geographic areas, (2) using auctions set aside exclusively for small and rural businesses, and (3)

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<sup>22</sup>Underlay rights allow unlicensed users to operate in the same spectrum bands as licensees, as long as the unlicensed users do not cause undue interference for licensees. For example, ultra-wideband technology operates at very low power levels over a very wide range of spectrum, and thus might avoid interfering with licensed spectrum users in the same spectrum bands. Overlay rights allow unlicensed users to operate in licensed spectrum bands during times or in geographic areas where licensees are not using the spectrum.



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providing better lease options for small and rural businesses. Finally, some industry stakeholders with whom we spoke have benefited from the small business incentive programs, such as bidding credits,<sup>23</sup> and believe that these incentives have been an effective means to promote small business participation in wireless markets.

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## Reexamine the Use and Distribution of Spectrum

Panelists on our expert panel suggested a reexamination of the use and distribution of spectrum to ensure the most efficient and effective use of this important resource. One panelist noted that the government should have a good understanding of how much of the spectrum is being used. To gain a better understanding, a few panelists suggested that the government systematically track usage, perhaps through a “spectrum census.” This information would allow the government to determine if some portions of spectrum were underutilized, and if so, to make appropriate allocation changes and adjustments.<sup>24</sup>

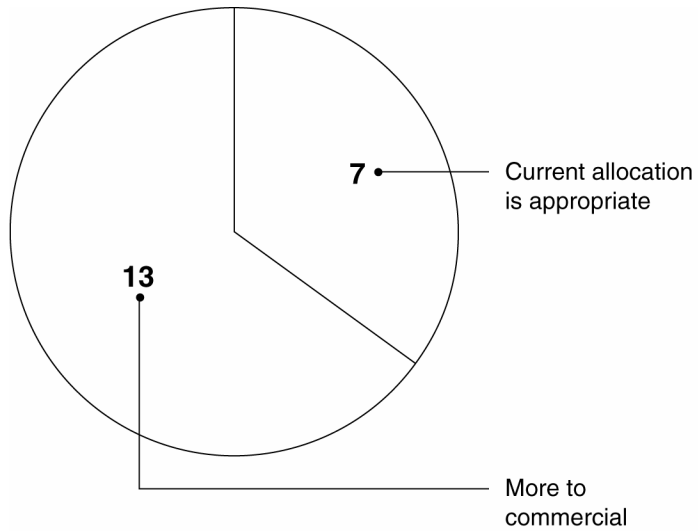
A number of panelists on our expert panel also suggested that the government evaluate the relative allocation of spectrum for government and commercial use as well as the allocation of spectrum for licensed and unlicensed purposes. While panelists thought the relative allocation between these categories should be examined, there was little consensus among the panelists on the appropriate allocation. For instance, as shown in figure 2, 13 panelists indicated that more spectrum should be dedicated to commercial use, while 7 thought the current distribution was appropriate; no panelists thought that more spectrum should be dedicated to government use. Similarly, as shown in figure 3, nine panelists believed that more spectrum should be dedicated to licensed uses, six believed more should be dedicated to unlicensed uses, and five thought the current balance was appropriate.

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<sup>23</sup>A bidding credit is a percentage discount applied to the high bid amount if the bidder meets designated entity criteria established in the auction rules. In February 2006, FCC issued a notice of proposed rule making to consider whether its general competitive bidding rules should be modified.

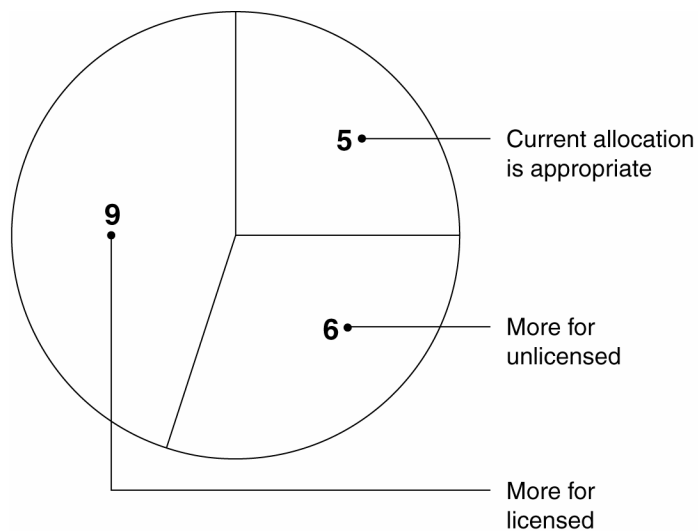
<sup>24</sup>In February 2006, the Technology CEO Council released a report entitled, *Freeing Our Unused Spectrum: Toward a 21st Century Telecom Policy* (Washington, D.C.: Feb. 2006). This report included recommendations for FCC and NTIA to examine how efficiently spectrum bands are being used and encourage more efficient use of bands that are not found to be used efficiently.

**Figure 2: Panelists' Views on the Allocation of Spectrum between Commercial and Government Use**



Source: GAO.

**Figure 3: Panelists' Views on the Allocation of Spectrum between Licensed and Unlicensed Use**



Source: GAO.

**Ensure Clearly Defined Rights and Flexibility**

Similar to a suggested modification of FCC's auction authority, some panelists on our expert panel suggested better defining users' rights and

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increasing flexibility in the allocation of spectrum. Better defining users' rights would clarify the understanding of the rights awarded with any type of license, whether the licensees acquired the license through an auction or other means. In addition, some panelists stated that greater flexibility in the type of technology used—and service offered—within frequency bands would help promote the efficient use of spectrum. In particular, greater flexibility would allow the licensee to determine the efficient and highly valued use, rather than relying on FCC-based allocation and service rules. However, some panelists on our expert panel and industry stakeholders with whom we spoke noted that greater flexibility can lead to interference, as different licensees provide potentially incompatible services in close proximity.<sup>25</sup> Thus, panelists on our expert panel stressed the importance of balancing flexibility with interference protection.

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## The Current Framework for Spectrum Management May Pose Barriers to Reform

Under the current management framework, neither FCC nor NTIA has been given ultimate decision-making authority over all spectrum use or the authority to impose fundamental reform, such as increasing the reliance on market-based mechanisms. FCC manages spectrum for nonfederal users while NTIA manages spectrum for federal government users.<sup>26</sup> As such, FCC and NTIA have different perspectives on spectrum use. FCC tends to focus on maximizing public access to and use of the spectrum. Alternatively, NTIA tends to focus on protecting the federal government's use of the spectrum from harmful interference, especially in areas critical to national security and public safety. Further, despite increased communication between FCC and NTIA, the agencies' different jurisdictional responsibilities appear to result in piecemeal efforts that lack the coordination to facilitate major spectrum reform. For example, FCC's and NTIA's recent policy evaluations and initiatives—the FCC Spectrum Policy Task Force and the Federal Government Spectrum Task

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<sup>25</sup>With the current allocation process, FCC attempts to keep incompatible service separated to avoid interference. With licensees exerting greater control, this protection could be reduced.

<sup>26</sup>In some countries, a single government entity regulates spectrum for all users. For example, Industry Canada has exclusive spectrum management responsibility in Canada.

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Force, respectively—tend to focus on the issues applicable to the users under their respective jurisdictions.<sup>27</sup>

Major spectrum reform must ultimately address multidimensional stakeholder conflicts. One source of conflict relates to balancing the needs of government and private-sector spectrum users. Government users have said that because they offer unique and critical services, a dollar value cannot be placed on the government's provision of spectrum-based services. At the same time, private-sector users have stated that their access to spectrum is also critical to the welfare of society, through its contribution to a healthy and robust economy. A second source of conflict relates to balancing the needs of incumbent and new users of spectrum. Since most useable spectrum has been allocated and assigned, accommodating new users of spectrum can involve the relocation of incumbent users. While new users of spectrum view relocations as essential, incumbent users often oppose relocations because the moves may impose significant costs and disrupt their operations. A third source of conflict relates to existing technology and emerging technology. Some new technologies, such as ultra wideband,<sup>28</sup> may use the spectrum more efficiently, thereby facilitating more intensive use of the spectrum. However, users of existing technology, both commercial and government, have expressed concern that these new technologies may create interference that compromises the quality of their services.

The current spectrum management framework may pose a barrier to spectrum reform because neither FCC nor NTIA has ultimate authority to impose fundamental reform and these stakeholder conflicts cross the jurisdictions of both FCC and NTIA. As such, contentious and protracted negotiations arise over spectrum management issues. We previously made two recommendations to help further the reform process. First, we recommended that the Secretary of Commerce and FCC should establish and carry out formal, joint planning activities to develop a national spectrum plan to guide decision making.<sup>29</sup> Additionally, we also recommended that the relevant administrative agencies and congressional

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<sup>27</sup>At a recent NTIA-sponsored workshop addressing spectrum management, the topics discussed included issues relevant for both FCC and NTIA, and the participants included spectrum managers from several government agencies, as well as FCC officials, commercial users, and other experts.

<sup>28</sup>Ultra wideband devices emit a low-power signal over large swaths of spectrum.

<sup>29</sup>[GAO-02-906](#).

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committees work together to develop and implement a plan for the establishment of an independent commission that would conduct a comprehensive examination of current spectrum management.<sup>30</sup> To date, neither recommendation has been implemented.

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## Concluding Observations

With authorization from Congress, FCC has taken several steps to implement a more market-oriented approach to spectrum management. In recent years, FCC has taken actions to facilitate secondary-market transactions. FCC authorized spectrum leasing for most wireless radio licenses with exclusive rights and also streamlined the procedures that pertain to spectrum leasing. In addition, FCC has conducted 59 auctions for a wide variety of spectrum uses, including personal communications services and broadcasting. FCC's auctions have contributed to a vibrant commercial wireless industry. The Congress' recent decision to extend FCC's auction authority was, in our opinion, a positive step forward in spectrum reform. However, more work is needed to ensure the efficient and effective use of this important national resource. To help reform spectrum management, we have previously recommended that (1) the Secretary of Commerce and FCC should establish and carry out formal, joint planning activities to develop a national spectrum plan to guide decision making; and (2) the relevant administrative agencies and congressional committees work together to develop and implement a plan for the establishment of a commission that would conduct a comprehensive examination of current spectrum management.<sup>31</sup> To date, these recommendations have not been implemented.

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Mr. Chairman, this concludes my prepared statement. I would be happy to respond to any questions you or other Members of the Committee may have at this time.

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<sup>30</sup> [GAO-03-277](#).

<sup>31</sup> [GAO-02-906](#) and [GAO-03-277](#).

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## Contact and Acknowledgments

For questions regarding this testimony, please contact JayEtta Z. Hecker on (202) 512-2834 or [heckerj@gao.gov](mailto:heckerj@gao.gov). Individuals making key contributions to this testimony include Amy Abramowitz, Michael Clements, Nikki Clowers, Eric Hudson, and Mindi Weisenbloom.

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