

FEDERAL COMMUNICATIONS COMMISSION

FCC 97-353

REPORT

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, D.C. 20554

In the Matter of )  
)  
FCC Report to Congress ) **WT Docket No. 97-150**  
on Spectrum Auctions )

**REPORT**

**Adopted: September 30, 1997 Released: October 9, 1997**

By the Commission:

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## I. Introduction

In 1993, Congress authorized the Federal Communications Commission to use auctions to award licenses for the rights to use the radio spectrum.<sup>1</sup> This Congressional act helped usher in a new era of telecommunication history. The FCC auctions have dramatically changed the way spectrum licenses are valued, distributed, and aggregated. These changes have fostered the entry of new companies into the market and encouraged the development of innovative wireless technologies.

In only four years, FCC spectrum auctions have awarded more than 4,300 licenses to auction winners who are either offering or preparing to offer service to the public in nine different wireless and satellite categories. Winning net bids in FCC spectrum auctions have totaled \$23 billion, with about \$12 billion of this amount collected for the U.S. Treasury to date.<sup>2</sup> Consistent with Congress' mandate under Section 309(j), about 53 percent of the licenses awarded thus far have been to small businesses, although the larger licensees tend to control geographic areas with greater populations. Given this success, Congress has extended the Commission's auction authority to the year 2007, and has expanded the FCC auctions program to encompass more radio spectrum to be auctioned in the future.<sup>3</sup>

The 1993 Budget Act requires the Commission to submit a report to Congress by September 30, 1997, generally evaluating the first four years of implementing auction authority. Under Section 309(j)(12) of the Communications Act, the report is to consist of the following elements:

- o a statement of the revenues obtained, and a projection of future revenues, from the use of competitive bidding systems;
- o a description of the methodologies and regulations established by the Commission in designing systems of competitive bidding;
- o a comparison of the relative advantages and disadvantages of such methodologies in terms of attaining the 1993 Budget Act's statutory objectives;

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<sup>1</sup> As part of the Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, § 6002, 107 Stat. 312, 387-392 (the "1993 Budget Act"), Congress added Section 309(j) to the Communications Act of 1934, as amended (the "Communications Act"), authorizing the Federal Communications Commission (the "FCC" or "Commission") to award licenses for rights to use the radio spectrum through competitive bidding.

<sup>2</sup> This figure represents monies received from auction winners as of August 31, 1997, many of whom are paying installments over the term of their licenses (generally 10 years).

<sup>3</sup> See Balanced Budget Act of 1997, Pub. L. No. 105-33, §§ 3002-3004, 111 Stat. 251, 258-268 (1997).

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*"The new auction paradigm has drawn entry and new financing into telecommunications markets and has spurred the marketing of new technologies and the building of transmission capacity to meet growing demand."*

Source: Thomas J. Duesterberg & Peter K. Pitsch, *Wireless Services, Spectrum Auctions, and Competition in Modern Telecommunications*, Outlook (May 1997), p. 7 (Duesterberg & Pitsch).

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- o an evaluation of whether and to what extent —
  - (i) competitive bidding significantly improved the efficiency and effectiveness of the process for granting radio spectrum licenses;
  - (ii) competitive bidding facilitated the introduction of new spectrum-based technologies and the entry of new companies into the telecommunications market;
  - (iii) competitive bidding methodologies have secured prompt delivery of service to rural areas and have adequately addressed the needs of rural spectrum users; and
  - (iv) small businesses, rural telephone companies, and businesses owned by members of minority groups and women were able to participate successfully in the competitive bidding process; and
- o recommendations of statutory changes that are needed to improve the competitive bidding process.

The FCC respectfully submits this report in fulfillment of Section 309(j)(12) of the Communications Act.<sup>4</sup>

## II. Overview

Section 309(j) of the Communications Act authorizes the Commission to use auctions to promote efficient and intensive spectrum use as well as to promote the development and rapid deployment of new technologies, products and services for the benefit of the public, including those residing in rural areas, without administrative or judicial delays. This subsection also requires the Commission to administer the auctions so as to promote economic opportunity and competition, avoid excessive concentration of licenses, and disseminate licenses among a wide variety of applicants, including small businesses, rural telephone companies, and businesses owned by members of minority groups and women.

This report explains how the Commission's auctions have achieved each of these goals. Evidence from the Commission's past license assignment methods and recent experience with auctions indicate that the auction approach has provided significant improvements over past methods, such as comparative hearings and lotteries, that were used by the Commission to award spectrum licenses. The Commission's auctions program has demonstrated the ability to award licenses to productive users, to encourage the emergence of innovative firms and technologies, to generate valuable market information, and to raise revenues for the public. In addition, small businesses have successfully participated in the FCC auctions. Auctions have achieved all of this more rapidly and at a lower administrative cost than comparative hearings or lotteries, the FCC's previous methods of distributing licenses.

There are many reasons why auctions are an improvement over other license assignment mechanisms. By requiring firms to use their own resources to compete for valuable spectrum, auctions encourage firms

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<sup>4</sup> This Report draws upon the work of Dr. Daniel Vincent, Associate Professor of Economics at the University of Western Ontario, who has published numerous academic articles on auctions and auction theory. Professor Vincent was retained by the FCC to contribute to this Report.

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One auction participant observed that the Commission's competitive bidding process is "*an efficient and effective procedure for awarding wireless licenses to those carriers that can make the best use of the spectrum.*"

Source: Bell Atlantic/NYNEX Comments filed in response to *Public Notice* FCC 97-232, at 1 (August 1, 1997).

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who value the spectrum the most to use it productively and in innovative ways. Auctions also provide valuable information about the opportunity cost of spectrum because they reflect the value that the next most efficient firm places on the spectrum license. This information allows both the private marketplace and policy makers to manage spectrum more effectively.

Congress' mandate presented the Commission with multiple objectives. For example, the statute requires the FCC to promote efficient and intensive spectrum use. Congress also sought to encourage the entry of

small businesses and previously under-represented groups (e.g., women and minorities) into the wireless telecommunications industry. After reviewing conventional auction designs, such as sequential or sealed bid auctions, the FCC developed an innovative methodology for auctioning a large number of licenses at one time, dubbed the "simultaneous multiple-round auction." In addition to its auction design, the FCC added a combination of incentives and set-asides to encourage participation by a variety of new entrants.

The simultaneous multiple-round bidding methodology successfully met the multiple goals for which it was designed. This auction format was economically efficient, flexible and able to accommodate efficient license aggregation. Bidder preference programs and spectrum set-asides were also successful -- both in encouraging many small firms to participate in the bidding process, and in awarding licenses to a diverse group of small firms in spectrum-based services. Indeed, a wide variety of businesses won licenses, including rural telephone companies and small businesses owned by minorities and/or women.

To implement this new design, the FCC pioneered the creation of an electronic bidding system that could handle the complex needs of the simultaneous multiple-round bidding. This Automated Auction System ("AAS") is capable of processing tens of thousands of bids, placed through computer terminals located anywhere a telephone can reach. With this innovative auction bidding system and unique simultaneous multiple-round auction design in place, the first FCC auction commenced on July 25, 1994.

### **The Automated Auction System is a Winner**

The FCC recently won an award from the Smithsonian Institution for its Automated Auction System. The 1997 Computer World-Smithsonian Award was granted for the system's cutting-edge contribution to the information technology revolution.

Another reason for the success of the Commission's auction program is its flexibility and responsiveness to bidders and the public. The FCC uses seminars, public notices, bidder information packages, the Internet, and messages transmitted over the bidding system itself, to communicate with bidders and other interested parties about its auctions. The resulting dialogue has led to a dynamic and evolving auctions program.<sup>5</sup> The Commission is continually improving

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<sup>5</sup> Most recently, the Commission conducted a public inquiry on the auctions program in conjunction with this Report to Congress, pursuant to Section 309(j)(12) of the Communications Act. See *Public Notice*, "Inquiry on

its auction process, and in a pending rulemaking proceeding, as well as in this Report, a number of proposed changes to auction design and procedures are recommended.<sup>6</sup> Moreover, the FCC has consistently taken steps to anticipate needed change -- especially where innovation and auction design are concerned. Even before the recent enactment of legislation in the Balanced Budget Act of 1997 ("BBA of 1997"), which calls for experimentation with "combinatorial bidding," the Commission had initiated a contract to evaluate the use of this bidding methodology. A description of combinatorial bidding is found in Box 1.

### **Box 1: Combinatorial Bidding**

Combinatorial bidding, also known as "package bidding," allows bidders to place single bids for groups of licenses. For example, in one type of combinatorial auction, bidder A could place a bid of \$100,000 for licenses 1, 2 and 4, while bidder B places a bid of \$500,000 for licenses 2, 3 and 5. The computer system then calculates the revenue maximizing solution and awards the high bids for that round to the appropriate package(s).

Combinatorial bidding has advantages over other auction designs when there are strong synergies among items being auctioned and strong and divergent preferences among bidders. In the FCC auctions, strong synergies exist when licenses are worth more to some bidders as a package than individually. Strong and divergent preferences occur, for example, when a large company's business plan is not viable unless it is awarded a nationwide service area, whereas smaller users may desire the same spectrum for local service and need only a smaller service area.

As described below in more detail, the Commission has also developed recommendations for legislative action that could significantly improve the auction process. Specifically, the Commission recommends that Congress:

- (1) **Clarify that FCC licensees who default on their installment payments may not use bankruptcy litigation to refuse to relinquish their spectrum licenses for reauction.** Legislation to this effect would ensure that the Commission could reclaim a license without delay when a licensee files for bankruptcy.
- (2) **Give the Commission explicit statutory authority to manage its installment payment portfolio flexibly, in a manner comparable to other government agencies that lend funds to regulated entities.** Other agencies have explicit statutory authority to flexibly service their

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Competitive Bidding Process for Report to Congress," WT Docket No. 97-150, FCC 97-232 (rel. July 2, 1997). Eighteen parties filed comments. A list of those who submitted comments is attached to this Report in Appendix A. Unless specified otherwise, the citations to comments throughout this Report refer to those comments filed in response to *Public Notice* FCC 97-232.

<sup>6</sup> See Amendment of Part 1 of the Commission's Rules -- Competitive Bidding Proceeding, WT Docket No. 97-82, *Order, Memorandum Opinion and Order, and Notice of Proposed Rule Making*, FCC 97-60 (rel. February 28, 1997) (*Part 1 Order*).

payment programs outside the purview of the Federal Claims Collection Standards, and the FCC would like this greater flexibility for the auctions program.

- (3) **Exempt all auction rulemakings from the regulatory requirements of the Contract With America Advancement Act.** Congress exempted the 2.3 GHz auction (Wireless Communications Services) from these requirements because it recognized the negative impact on auction timing. The FCC would benefit from applying the same exemption to all auction rulemakings.
- (4) **Exempt auctions contracts from certain provisions of the Federal Acquisitions Regulations.** Auction staffing requirements vary from auction to auction. Thus, additional flexibility in hiring and retaining the services of contractors would assist the auctions program.
- (5) **Modify the statute of limitations for forfeiture proceedings against non-broadcast licensees from one to three years.** This modification would allow the Commission to more effectively enforce its rules and help ensure the integrity of the auctions and other Commission processes.

The FCC auction program has been widely recognized as a success. The FCC has not only met the goals mandated by Congress but also met its primary responsibilities to adopt fair rules, run fair auctions, and rapidly issue licenses to successful bidders. Moreover, FCC auctions have benefitted the American public by recovering at least a portion of the value of the spectrum resource.<sup>7</sup>

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<sup>7</sup> See 47 U.S.C. § 309(j)(3)-(4).

### III. A History of Comparative Hearings, Lotteries, and Auctions

The radio spectrum is a resource that is limited in supply and able to sustain only a certain number of users at any one time, despite the technological advances that have dramatically improved the ability to use spectrum more efficiently over time. A variety of mechanisms can be used to distribute such scarce resources among users. Historically, the FCC has used auctions, lotteries, and assignment by comparative hearing to award licenses for the use of radio spectrum.

#### *Comparative Hearings*

Initially, the Commission was largely limited to the use of comparative hearings as a means to distribute spectrum licenses.<sup>8</sup> The Commission granted licenses on a first-come, first-served basis, unless more than one party applied for the same license, a situation called mutual exclusivity. For much of this century, when such cases occurred, spectrum licenses were granted using the "public interest, convenience, or necessity" standard to decide among competing, mutually exclusive applicants, in what became known as comparative hearings. Comparative hearings gave competing applicants a quasi-judicial forum in which to argue why they should be awarded a license over competitors, and allowed other interested parties to argue for or against an applicant.

Comparative hearings were often time consuming and resource intensive from the perspective of both the applicants and the Commission. For example, grants of the initial licenses for cellular service were made based on comparative hearings. The strong demand for this scarce resource resulted in over 200 requests

#### **What is Spectrum?**

"Spectrum" is a conceptual tool used to organize and map a set of physical phenomena. Electric and magnetic fields produce waves that move through space at different frequencies (defined as the number of times that a wave's peak passes a fixed point in a specific period of time), and the set of all possible frequencies is called the "electromagnetic spectrum." The subset of frequencies from 3,000 cycles per second (3 kilohertz (kHz)) to 300 billion cycles per second (300 gigahertz (GHz)) is known as the "radio spectrum." Familiar radio spectrum services are AM radio (535 kHz to 1,705 kHz), FM radio (88 MHz to 108 MHz), television (various allocations between 54 MHz to 806 MHz), and cellular phones (806 MHz to 890 MHz). Frequencies in the radio spectrum are divided between federal and nonfederal use. The National Telecommunications and Information Administration manages the federal spectrum, allocating and assigning licenses to federal users. The FCC manages the nonfederal portion of the spectrum.

Source: *Where Do We Go From Here? The FCC Auctions and the Future of Radio Spectrum Management*, Congressional Budget Office, Congress of the United States (April 1997) pp. 2-4 (*CBO Study*).

<sup>8</sup> In *Ashbacker Radio Corp. v. FCC*, 326 U.S. 327 (1945), the United States Supreme Court held that if two *bona fide* license applications are mutually exclusive, the applicants are entitled to a comparative hearing. This applies to applicants, not potential applicants.

for the first 30 licenses, many of them consisting of well over 1,000 pages of detailed argument and documentation. The next two rounds of licensing attracted 344 and 567 applicants, respectively.<sup>9</sup> The task of evaluating and then awarding the licenses in an informed and equitable manner put a strain on Commission resources. In addition to the cost of evaluating licensees, the opportunity costs caused by delays using this method were high. The selection of licensees from a pool of applicants often took up to two years or longer to complete. Ultimately, the huge volume of applications for new licenses driven by the developing cellular telephone industry, led the FCC to seek authority to assign licenses by lottery.

### *Lotteries*

In 1981, Congress added Section 309(i) to the Communications Act to give the Commission the authority to assign a broad range of licenses by lottery.<sup>10</sup> In theory, lottery-based licensing would expedite service to the public and lower the cost of entry by applicants. Initially, the Commission screened applicants and allowed only qualified providers to participate in the lottery. Even this minimal degree of screening proved to be extremely burdensome on the Commission's resources. For example, it took twenty months for the first set of cellular applications to be screened before the lottery.<sup>11</sup>

By 1987, the FCC was forced to abandon pre-lottery screening and open the process to all potential applicants. "Application mills" sprang up to assist almost 400,000 different firms claiming to be spectrum "providers" in their efforts to win a cellular license,<sup>12</sup> and a broad range of spectrum speculators participated in and won lotteries in cellular, Specialized Mobile Radio ("SMR") and other services. Many license winners, with no intention of providing service to the public, were now eager to trade their license rights for windfall profits, and a secondary market in FCC licenses emerged. Even when lotteries themselves could be conducted quickly, it took years for secondary markets to reassign licenses to the parties that valued them the most and to aggregate these licenses efficiently. Delay in service to the public was often the result.

### *Costs*

The history of comparative hearings and lotteries highlights their flaws in efficiently and fairly awarding rights to use the radio spectrum. Both approaches, especially the lotteries, failed to ensure that licenses would quickly go to the most efficient firms. On average, it took about two years to award cellular

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<sup>9</sup> See *In the Matter of Amendment of the Commission's Rules to Allow the Selection from Among Mutually Exclusive Competing Cellular Applications Using Random Selection or Lotteries Instead of Comparative Hearings*, CC Docket No. 83-1096, *Report and Order*, 98 F.C.C. 2d 175 (1984).

<sup>10</sup> Omnibus Budget Reconciliation Act of 1981, Pub. L. No. 97-35, 95 Stat. 736-737, *amended*, Communications Amendment Act of 1982, Pub. L. No. 97-259, § 115, 96 Stat. 1087.

<sup>11</sup> See Thomas W. Hazlett and Robert J. Michaels, *Rent Dissipation in Competition for the Monopoly*, paper presented at the Western Economic Association Meetings, South Lake Tahoe, Nevada (June 1989) (*Hazlett and Michaels*), p. 15.

<sup>12</sup> See Thomas W. Hazlett, *Assigning Property Rights to Radio Spectrum Users: Why Did FCC License Auctions Take 67 Years?* (July 11, 1995), p. 6.

licenses in comparative hearings and over one year by lotteries.<sup>13</sup> The time to award a license does not fully measure delays to market, especially for lotteries, because licenses were often reassigned in secondary markets before service to the consumer commenced. The social costs of these delays in mobile telephony have been estimated by some to be substantial. It has been estimated that the ten year delay in cellular licensing cost the U.S. economy the equivalent of two percent of Gross National Product.<sup>14</sup>

Another significant expenditure was the total cost of producing applications under the lottery system. Hazlett and Michaels estimate it cost a potential participant \$800 to file an application for a cellular lottery.<sup>15</sup> This cost per application may not be much different from the cost per application for auctions but the number of applications filed under the lottery system was inflated by speculation. Since the FCC did not charge lottery participants for the license or a significant sum to participate in a lottery, the number of speculative applications under lotteries was higher and in turn, the total cost of producing applications has been estimated to be high. Given almost 400,000 cellular license applications, this number suggests that nearly \$300 million in total was spent on producing cellular applications for the lotteries.<sup>16</sup> In addition to the total application costs, the transaction costs associated with license resales after lotteries have been quite significant. For example, for the year 1991, these costs have been estimated at \$190 million.<sup>17</sup>

Both methods also encouraged wasteful use of resources, not only by the firms seeking to acquire licenses but also by the Commission. The demands associated with comparative hearings and lotteries overburdened the Commission's resources, which were not prepared for the deluge of applications. These methods also failed to capture for the public any of the monetary benefits that spectrum licenses garnered for the fortunate few who acquired them.

### *Auctions*

In the 1993 Budget Act, Congress added Section 309(j) to the Communications Act, authorizing the FCC to use competitive bidding to resolve mutual exclusivity among spectrum license applicants. Auctions were intended to correct problems associated with prior licensing methodologies: the cost of winning an auction would dissuade speculators, the value of the spectrum would go to the federal Treasury rather than

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<sup>13</sup> See Appendix E: FCC Licensing Speed.

<sup>14</sup> See J. H. Rohlfs, C. L. Jackson & T. E. Kelley, *Estimate of the Loss to the United States Caused by the FCC's Delay in Licensing Cellular Telecommunications*, National Economic Associates, Inc. (November 1991).

<sup>15</sup> See Hazlett and Michaels.

<sup>16</sup> An earlier estimate placed the cost of an average application at over \$3,500, suggesting over \$1 billion dollars of social resources drawn into the essentially unproductive activity of lottery applications. See Evan R. Kwerel & Alex Felker, *Using Auctions to Select FCC Licenses*, OPP Working Paper No. 16, Office of Plans and Policy, FCC (May 1985). They also estimate the cost of a much more detailed application under the comparative review system was \$130,000 per application.

<sup>17</sup> See Amendment of the Commission's Rules to Establish New Personal Communications Services, GEN Docket No. 90-314, ET Docket No. 92-100, *Notice of Proposed Rule Making and Tentative Decision*, 71 Fed. Reg. 5676, 5699 n.41 (1992) (*PCS Tentative Decision*).

to speculators, and the auction winners who valued the spectrum most would implement services quickly.

The 1993 Budget Act required the Commission to experiment with multiple bidding methodologies and determine the applicability of competitive bidding for awarding spectrum licenses so as to:

- o protect the public interest, and
- o promote specific objectives, including:
  - (a) speedy development and deployment of new technology and services to benefit the public, including rural areas;
  - (b) economic development and competition through broad distribution of licenses and diversity among license holders;
  - (c) recovery for the public of some of the commercial value of the spectrum and avoidance of unjust enrichment; and
  - (d) efficient and intensive spectrum usage.

Congress required the Commission to issue rules to implement its competitive bidding authority by March 8, 1994. The Commission issued a Notice of Proposed Rulemaking in October 1993, which invited comments from interested parties on a proposed auction format.<sup>18</sup> In addition, academic and industry conferences provided a forum for discussing different ways to organize FCC auctions. The FCC adopted its initial regulations governing general auction structure on March 8, 1994.<sup>19</sup>

Since then, the Commission has adopted specific rules for competitive bidding tailored to distinct services, and conducted auctions for those services. As of September 30, 1997, the Commission has conducted fourteen auctions and has awarded over 4,300 licenses for spectrum-based services.<sup>20</sup>

Table 1. below, highlights the results of the narrowband and broadband Personal Communications Service ("PCS") auctions, as well as the auction of other services including Interactive Video and Data Service ("IVDS") and Direct Broadcast Satellite ("DBS") orbital slots. These services represent new uses of the spectrum, employ new technology, and will be broadly available to the public. Detailed information about broadband PCS auction results can be found in Appendix C. The Commission has also adopted

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<sup>18</sup> See Implementation of Section 309(j) of the Communications Act – Competitive Bidding, PP Docket No. 93-253, *Notice of Proposed Rule Making*, 8 FCC Rcd 7635 (1993) (*Competitive Bidding NPRM*). The Commission received written comments from 222 parties and reply comments from 169 parties.

<sup>19</sup> See Implementation of Section 309(j) of the Communications Act – Competitive Bidding, PP Docket No. 93-253, *Second Report and Order*, 9 FCC Rcd 2348 (1994) (*Competitive Bidding Second Report and Order*), on reconsideration, *Second Memorandum Opinion and Order*, 9 FCC Rcd 7245 (1994) (*Competitive Bidding Second Memorandum Opinion and Order*). In its ongoing effort to utilize experiences from prior auctions to continually improve the auction mechanism, the Commission has recently amended, and sought comment on further changes to, this generic set of rules. See *Part 1 Order*, *supra* fn 6.

<sup>20</sup> As of September 30, 1997, the FCC has completed auctions with a total of 4,368 spectrum licenses. After an auction is closed, the FCC must proceed through a regulatory process specified by the Communications Act to grant the actual license. See 47 U.S.C. § 309(a)-(c) (action upon applications); *id.* § 309(d) (petition to deny process). To date, 4,004 of the licenses awarded at auction have been granted.

specific rules for the future auction of licenses in the Local Multipoint Distribution Service ("LMDS"), 220 MHz, 800 MHz Specialized Mobile Radio ("800 MHz SMR"), and paging services. Additionally, auctions are proposed for many other wireless services in the future.

As described more fully in the next sections of this report, the Commission's experience in these fourteen auctions shows that competitive bidding is a more efficient mechanism to assign spectrum in cases of mutual exclusivity than any previously employed methods. The Commission has also demonstrated a commitment to innovation in its development of unique auction formats. In contrast to comparative hearings and lotteries, the auction process rapidly awards licenses to productive users, encourages the emergence of innovative firms and technologies, generates valuable market information, and compensates the public for the use of the airwaves. The FCC auctions have also encouraged participation by small businesses. Finally, they have been able to achieve all of this more rapidly, and at a lower cost, than past licensing methods.

**Table 1: FCC Auction Results**

| Auction   | Number of Licenses (1) | Geographic Service Areas (2) | Service Description   | Total Spectrum (in megahertz) | Total Winning Bids (in millions) (3) | Bid Price: (dollars per person per MHz) |
|---|------------------------|------------------------------|-----------------------|-------------------------------|--------------------------------------|---|
| <b>Narrowband PCS</b>   |                        |                              |                       |                               |                                      |   |
| <b>Nationwide</b><br>(Jul. 25-29, 1994)   | 11 (4)                 | National                     | Advanced paging/data  | 0.7875 MHz                    | \$650.3                              | \$3.10                                  |
| <b>Regional</b><br>(Oct. 26 - Nov. 8, 1994)   | 30                     | Regional                     | Advanced paging/data  | 0.45 MHz                      | \$392.7                              | \$3.46                                  |
| <b>Broadband PCS</b>  |                        |                              |                       |                               |                                      |   |
| <b>A and B Blocks</b><br>(Dec. 5, 1994 - Mar. 13, 1995)                                   | 102 (5)                | MTAs                         | Mobile voice and data | 60 MHz                        | \$7,721.2                            | \$0.52                                  |
| <b>C Block (two auctions) (6)</b><br>(Dec. 18, 1995 - May 6, 1996<br>and Jul. 3-16, 1996) | 493                    | BTAs                         | Mobile voice and data | 30 MHz                        | \$10,102.1                           | \$1.33                                  |
| <b>D, E, and F Blocks (6)</b><br>(Aug. 26, 1996 - Jan. 14, 1997)                          | 1479                   | BTAs                         | Mobile voice and data | 30 MHz                        | \$2,517.4                            | \$0.33                                  |

(1) This is the total number of licenses in each service. Some of these licenses have not yet been granted.

(2) MTAs = Major Trading Areas, BTAs = Basic Trading Areas, MSAs = Metropolitan Statistical Areas, RSAs = Rural Service Areas, MEAs = Major Economic Areas, REAGs = Regional Economic Area Groups. See Appendix D for illustrative maps.

(3) Total Winning Bids includes high bids from the auction (net of any bidding credits) plus the price paid for any pioneer preference licenses.

(4) Includes one pioneer preference license.

(5) Includes three pioneer preference licenses.

(6) The Commission reserved the C and F blocks of broadband PCS for entrepreneurs and small businesses.

**Table 1 cont'd: FCC Auction Results**

| Auction   | Number of Licenses (1) | Geographic Service Areas (2) | Service Description   | Total Spectrum (in megahertz) | Total Winning Bids (in millions) (3) | Bid Price: (dollars per person per MHz) |
|---|------------------------|------------------------------|-----------------------|-------------------------------|--------------------------------------|---|
| <b>Other Services</b>   |                        |                              |                       |                               |                                      |   |
| <b>Interactive Video and Data Service</b> (July 28-29, 1994)          | 594                    | MSAs                         | Interactive data      | 1 MHz                         | \$213.9                              | \$0.85                                  |
| <b>Multipoint Distribution Service</b> (Jan. 13, 1996 - Mar. 28 1996) | 493                    | BTAs                         | Wireless cable        | 78 MHz (7)                    | \$216.2                              | \$0.067 (8)                             |
| <b>900 MHz Specialized Mobile Radio</b> (Dec. 5, 1995-Apr. 5, 1996)   | 1020                   | MTAs                         | Mobile voice and data | 5 MHz                         | \$204.3                              | \$0.24 (8)                              |
| <b>Direct Broadcast Satellite (9)</b>                                 |                        |                              |                       |                               |                                      |   |
| - Orbital Slot at 110 degrees west (Jan. 24-25, 1996)                 | 1                      | Full US coverage             | Multichannel video    | 437.5 MHz                     | \$682.5                              | \$0.0062                                |
| - Orbital slot at 148 degrees west (Jan. 25-26, 1996)                 | 1                      | Partial US coverage          | Multichannel video    | 375 MHz                       | \$52.3                               | \$0.0006                                |
| <b>Cellular Unserved</b> (Jan. 13-21, 1997)                           | 14                     | MSAs and RSAs                | Mobile voice and data | 50 MHz                        | \$1.8                                | n/a                                     |
| <b>Wireless Communications Service</b> (Apr. 15-25, 1997)             | 128                    | MEAs and REAGs               | (10)                  | 30 MHz                        | \$13.6                               | \$0.0018                                |
| <b>Digital Audio Radio Service</b> (Apr. 1-2, 1997)                   | 2                      | Full US coverage             | Multichannel audio    | 25 MHz                        | \$173.2                              | \$0.0274                                |
| <b>Total</b>  | <b>4,368</b>           |                              |                       |                               | <b>\$22,941.5</b>                    |   |

(7) To be precise, Multipoint Distribution Service ("MDS") total spectrum should be 76 MHz because Channel 2 was originally 6 MHz only in the top 50 markets. In the rest of the markets, it was Channel 2A with 4 MHz. As noted in the MDS Auction Procedures, Terms, and Conditions: "In 1992, the 2160-2162 MHz frequency was reallocated to emerging technologies, and thus, any subsequent MDS use of these 2 MHz will be secondary."

(8) Estimated to adjust for encumbered spectrum.

(9) There is a total of 500 MHz of DBS downlink spectrum available. The same spectrum can be reused at each of the eight U.S. DBS orbital slots. The figures in the table are (28/32) x500 and (24/32) x500, respectively, but they each refer to portions of the same 500 MHz of spectrum.

(10) WCS is permitted to implement a wide range of services, subject to FCC engineering requirements, including fixed, mobile, radio location, and broadcasting-satellite (sound) service.

## Box 2: Behind the Scenes at an FCC Auction

**Rules:** For the auction of licenses in any particular service, the Commission establishes the requisite technical, service, and competitive bidding rules through notice and comment rulemaking in accordance with the Administrative Procedures Act. Once rules are promulgated, the Wireless Telecommunications Bureau initiates the following process.

**Initial Public Notice:** A Public Notice announces the date of the auction and the deadline for filing "short-form" applications to participate in the auction. The Public Notice specifies the licenses to be auctioned; the method of competitive bidding to be used in the event mutually exclusive applications are filed; the deadline for submitting the upfront payment and the amount of that payment for each license; and applicable bid requirements and other auction procedures.

**Bidder Information Package:** Soon after the release of the initial Public Notice, a Bidder Information Package is made available to prospective bidders. The Bidder Information Package generally contains detailed information about the auction and auction procedures, as well as information about incumbent licensees (if the spectrum has incumbents) based on the Commission's licensing records.

**Status of Applications Public Notice:** After reviewing the short-form applications, but prior to the upfront payment deadline, a Public Notice advises applicants of the status of their short-form applications. Applicants whose short-form applications are accepted or rejected are identified, and those applicants whose short-form applications are substantially complete, but contain minor errors or defects, are identified and provided a limited opportunity to correct their applications prior to the auction.

**Qualified Bidders Public Notice:** After the upfront payment deadline has passed, the Bureau issues a Public Notice identifying the applicants who are qualified to participate in the auction. *i.e.*, those applicants whose short-form applications were accepted for filing and who timely submitted upfront payments sufficient to make them eligible to bid on at least one of the licenses for which they applied.

**Pre-Auction Assistance to Qualified Bidders:** All qualified bidders are eligible to participate in a mock auction which enables them to become familiar with the software prior to the beginning of the auction. In some instances, the Commission also conducts a pre-auction seminar for qualified bidders. Registration materials are usually distributed by two overnight mailings, each containing part of a confidential identification code required for the bidder to place bids.

**Auction:** The auction is conducted and bids are accepted in each round of the auction. Round results and other related reports are provided during the course of the auction. Such reports compile results of all bids placed, current high bids, withdrawn bids, and the status of other auction procedures. During the auction, announcements are made directly to bidders via the automated bidding system. Round results and other important information are also posted to the Internet and the FCC electronic bulletin board.

**Auction Closing Public Notice:** After the close of the auction, a Public Notice announces the winning bidder for each license and establishes the deadline and procedures for winning bidders to make payment. The Public Notice will also include information about filing the "long-form" application necessary to obtain the license. Long-form applications are subject to review pursuant to the Communications Act. Under the statute, interested parties are given an opportunity to file petitions to deny against auction winners, and the Commission must determine whether such petitions have merit.

#### IV. The FCC Spectrum Auctions: Auction Theory, Design, and Practice

Unlike many items that traditionally are sold at auction, licenses for the right to use radio spectrum are often highly interdependent. In other words, a combination of these licenses could be worth more to a licensee than the sum of the individual licenses, due to factors like the benefit to consumers of seamless roaming over wide geographic areas, economies of scale in marketing, and efficiencies from better coordination of spectrum use.

Following the passage of legislation authorizing the FCC to use auctions to assign spectrum licenses, the FCC was faced with the monumental task of developing an auction methodology and an automated system to begin awarding spectrum licenses using competitive bidding. Because traditional auction designs posed significant challenges for bidders trying to aggregate multiple licenses, the Commission used a unique and pioneering auction methodology: the simultaneous multiple-round auction. This design has proven to be flexible enough to take into account the complexities associated with auctioning radio spectrum.

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*"The recently completed FCC auctions of narrowband and broadband licenses for spectrum have been a spectacular success. They have demonstrated the awesome ability of markets to allocate valuable public resources efficiently. History has been made by these auctions."*

Source: Opinion, "The Auction Process Worked," Communications Week, April 24, 1995.

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Since the simultaneous multiple-round auction methodology had never been used outside of "the laboratory" when the FCC adopted it, an auction system to implement this design had to be built from the ground up. The FCC's Automated Auction System was constructed to provide the necessary tools to process thousands of bids instantaneously and generate round results within a few minutes following the conclusion of each bidding round. This auction system accommodates the needs of bidders by allowing them to bid remotely using a personal computer and a modem via a private and secure wide area network.

##### A. Auction Theory

To adopt auction rules by the March 8, 1994 statutory deadline, the Commission hosted a series of rigorous discussions on auction theory. Academics, economists, and policy makers all gathered to discuss the best way to auction spectrum. Much of the debate centered on how to design auctions that appropriately take into account the interdependence of license values -- that provide bidders with information about the prices of complementary and substitute licenses, facilitate pursuit of backup strategies as more information becomes known, and promote aggregation of licenses into efficient bundles. Auction theory provided some useful general principles in developing a good auction design, including:

- o **Auctions perform better when private information is made broadly known.** If a seller has information that affects the future value of the good that is to be sold, then it is preferable to reveal that information whether it is good or bad. In the case of spectrum auctions, this includes future regulatory intentions of the government, plans to provide further spectrum rights, or information

about future market conditions.

- o **Auctions perform better when it is difficult for bidders to keep their information private.** Since bidders' private information affects their bids, a choice of open outcry or multiple-round auctions allows bidders to observe opponents' bids and draw inferences about the private information that is driving the bids. This ability can reduce the phenomenon known as the *winner's curse*, which arises when a high bidder fails to recognize that all the potentially well-informed rivals are more pessimistic about the future profitability of a license. If the high bidder does not downgrade estimates to take this fact into account, he risks paying more for the license than it is worth. If other bids cannot be observed, the concern raised by this possibility will induce bidders to reduce their bids by more than if other bidders' activity can be monitored.

## **B. Designing the FCC Spectrum Auctions**

A well designed auction should produce a socially efficient distribution of scarce goods because it awards goods to those willing to pay the highest price. The auction price reflects what the winner thinks it can earn by using the goods. Thus, the competitive bidding process provides incentives for licensees of spectrum to compete vigorously with existing services, develop innovative technologies, and provide improved products to realize expected earnings. In this way, awarding spectrum using competitive bidding aligns the licensees' interests with the public interest in efficient utilization of the spectrum. As one commenter observes, "[s]uccessful bidders are those that not only place a high value on the property relative to other auction participants, but also have the financial capability to support their bids."<sup>21</sup>

FCC staff used the theoretical principles discussed above as guidelines for their auction plan. Designers also had to consider the desirability of the license, its independence/interdependence with other licenses at auction; and the number of licenses to be awarded in determining the choice of design most appropriate for a particular auction.

### **1. FCC Spectrum Auction Design Challenges**

In the process of designing the optimal auction methodology for spectrum auctions, the Commission grappled with numerous complicated issues. The Commission has an obligation under Section 309(j) to promote the participation of small businesses, rural telephone companies, and women- and minority-owned businesses, and to achieve an economically efficient outcome. Designing an approach to balance multiple, complex objectives was a monumental task. In the pursuit of these general goals, the FCC auction designers faced two challenges specific to spectrum auctions.

#### *Allowing for License Aggregation*

First, the auction designers had to take into consideration that, in many services, the large number of licenses to be auctioned, and their interdependence, made aggregation of licenses attractive to bidders. Licenses can be aggregated by frequency band and by geographic area. For a given frequency band, a firm might wish to acquire a number of contiguous geographic areas in order to offer consumers seamless

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<sup>21</sup> AMTA Comments filed in response to *Public Notice* FCC 97-232, at 3 (August 1, 1997).

convenience, to pool marketing costs, and to coordinate band use on the borders of the areas. For a given geographic area, a firm might wish to obtain additional spectrum to increase its bandwidth.

Aggregation may also facilitate the adoption of new technologies and services. For example, if a company uses an innovative technical standard for its equipment that is not compatible with other standards, then aggregating licenses in adjacent geographic areas would allow the company to provide seamless service over a large area.

### *Preventing Collusion*

The second issue the FCC had to resolve was the inherent conflict between using auctions that reveal information about other participants' bidding behavior and the possibility of unlawful collusion. Allowing more information to be revealed in the auction process reduces the chances of the winners curse and produces the most efficient auction results. However, some auction theorists argued that collusion was more likely to occur in a simultaneous multiple-round auction.<sup>22</sup> To address this potential problem, the FCC created stringent rules (as discussed in Box 3) to counter the possibility of collusion.<sup>23</sup> For example, the FCC adopted explicit anti-collusion rules that prohibit firms that have applied for common markets from collaborating, discussing, or disclosing, in any manner, the substance of their bids or bidding strategies.<sup>24</sup> The FCC relied on these rules, along with existing Federal antitrust laws, to deter collusive behavior.

More recently, the FCC has made other bidding changes to address concerns about potential collusion in its auctions. For example, the FCC is considering changing its bidding system so that bidders will no longer have the flexibility to type a bid of any amount they choose. Instead, bidders will simply "click" on the appropriate box to place a bid at the minimum acceptable bid amount set by the Commission for a particular license. While this modification restricts bidders' flexibility, it is expected to address concerns about bid amounts that may be used to "signal" market intentions. The FCC is also considering limiting the number of bid withdrawals that can be made during an auction to ensure that firms do not engage in such behavior for strategic advantage.

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<sup>22</sup> Auction consultant Barry Nalebuff and game theorist Adam Brandenburger made this argument on the McNeil-Lehrer NewsHour (PBS television broadcast, February 3, 1993).

<sup>23</sup> See *Competitive Bidding Second Report and Order*, 9 FCC Rcd at 2386-88; Implementation of Section 309(j) of the Communications Act - Competitive Bidding, PP Docket No. 93-253, *Fourth Memorandum Opinion and Order*, 9 FCC Rcd 6858, 6866-69, *on recon.*, *Memorandum Opinion and Order*, 9 FCC Rcd 7684, 7687-89 (1994).

<sup>24</sup> See 47 C.F.R. § 1.2105(c). The FCC has also made use of other tools to address collusion or undesirable strategic behavior by bidders. For example, the FCC has limited the bidding information that is made available during an auction. See *Competitive Bidding Second Report and Order*, 9 FCC Rcd at 2375. See also *Competitive Bidding Second Memorandum Opinion and Order*, 9 FCC Rcd at 7251-52.

### Box 3: Preventing Collusion in Spectrum Auctions

In the *Competitive Bidding Second Report and Order*, the Commission adopted rules designed to prevent and facilitate the detection of collusive conduct in order to enhance and ensure the competitiveness of both the auction process and the post-auction market structure.

The Commission's anti-collusion rule requires that auction applicants identify any parties with whom they have entered into any consortium arrangements, joint ventures, partnerships or other agreements or understandings which relate in any way to the competitive bidding process. Applicants are also required to certify that they have not entered into any explicit or implicit agreements, arrangements or understandings of any kind with any parties, other than those identified, regarding the amount of their bids, bidding strategies, or the particular markets on which they will or will not bid.

With certain limited exceptions, from the time auction applications are filed prior to auction until the time that the winning bidder has made its required down payment, all bidders are prohibited from cooperating, collaborating, discussing or disclosing in any manner the substance of their bids or bidding strategies with other bidders that have applied to bid in the same geographic license area, unless such bidders are members of a bidding consortium or other joint bidding arrangement identified on the bidder's short-form application.

The Commission has indicated that it will conduct a detailed investigation of any specific allegations that an auction participant has violated the anti-collusion rule. In addition, where allegations may give rise to violations of the federal antitrust laws, the Commission will investigate and/or refer such cases to the United States Department of Justice for investigation. Bidders who are found to have violated the Commission's anti-collusion rules in connection with their participation in the auction process may, among other sanctions, be subject to the loss of their down payment or their full bid amount, face the cancellation of their licenses, and be prohibited from participating in future auctions.

The Commission first became aware of allegations of "bid signaling" (e.g., the use of particular trailing digits on a bid to signal other bidders) in late 1996, during the PCS D, E and F block auction, when it received a complaint from a bidder who believed that a competing bidder was using unusual bid amounts to "signal" its market intentions. The Commission has begun an investigation into the allegations and is also examining bidding records from previous auctions to determine whether this practice occurred in the past. In addition, the Commission has referred the allegations to the Department of Justice, which is conducting its own investigation.

## 2. The Simultaneous Multiple-Round Auction Design

Key auction design elements that had to be considered by the Commission included the number of auction rounds (single or multiple) and the order in which licenses are auctioned (sequentially or simultaneously). These design elements affect how much information about the bidding is available during the auction and the ability to pursue backup strategies. The advantages and disadvantages of different methods had to be evaluated, taking into account the degree of interdependence among particular licenses. A brief explanation of several auction methodologies is set forth below:

- o **Single-round sealed-bid auctions.** The bidder has only one chance to make an offer and can not increase the offer at a later time. In the case of spectrum auctions, a single bid would be submitted by each bidder and the license awarded to the high bidder.
- o **Multiple-round open auctions.** The bidders are allowed the opportunity to assess the bids at the end of each round and top the high bid in the next round. This is the format of the typical oral outcry auction. A bidder has the opportunity to keep increasing its bid until it obtains the license.

The multiple-round auction's main advantages are that it provides information to bidders regarding the value other bidders place on licenses and allows them to act on that information. This information increases the likelihood that licenses will be assigned to bidders that value them most highly, because bidders do not have to guess about the value that the second highest bidder places on the license, as they do in a single-round auction. In the next round bidders have the opportunity to raise their bid if they are willing to pay more than the previous round's high bidder. In a single sealed-bid auction, bidders who bid incorrectly could fail to obtain the license even though their actual valuation is the highest. In multiple round auctions, bidders are also less likely to succumb to the winner's curse, discussed above. Furthermore, multiple-round auctions have the additional advantage of enhancing the credibility of the auction process. That is, the result is more likely to be perceived as open and fair.

- o Pure sequential auction. Licenses are auctioned one at a time. The bidding stops on one license before it begins on the next license. Sequential bidding has the advantage of administrative simplicity and also permits bidders to know what they and other bidders have won. However, sequential bidding does not allow a bidder to reevaluate past bids and shift strategies. In a sequential format, a bidder cannot go back and reconsider an early license after observing later bidding activity.
- o Simultaneous auction. A number of licenses are open to competitive bidding at the same time and bidding continues on the whole group until no additional bids are received on any license. The chief advantage of a simultaneous auction is that it provides information to bidders about the values of other licenses up for bid and, in a multiple-round auction, the opportunity to use that information to aggregate licenses or to shift their bidding from one license to another.

If all bidders desire similar aggregations and if these combinations are known, then the best resolution would be to define the licenses reflecting these interests. However, applicants may be interested in very different groups of licenses. A simultaneous auction lets the market determine the most efficient bundling of spectrum rights. A disadvantage of the simultaneous auction is the more elaborate rules that must be developed for the auction to operate smoothly. For instance, given the simultaneous bidding format, it is important to decide when the auction is declared over. Therefore certain "stopping rules" come into play as discussed in more detail below.

The Commission considered a number of different proposals for the design of the auctions, including: (1) a typical oral outcry auction, involving sequential, multiple-round bidding; (2) a sequence of electronic, multiple-round, single license auctions; and (3) single-round bidding, *i.e.*, sealed bids.<sup>25</sup> The Commission determined that these methods were inadequate where strong interdependencies and license aggregation were an issue.

In those instances where license aggregation was not an important issue, however, the Commission used alternative auction designs. For example, the Commission utilized a sequential, oral outcry procedure for the IVDS auction in July 1994. At that time, the Commission reasoned that the small degree of interdependency among the IVDS licenses was not enough to justify the cost and administrative

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<sup>25</sup> See *Competitive Bidding NPRM*, 8 FCC Rcd at 7641-43.

complexities associated with holding a simultaneous multiple-round auction.<sup>26</sup> Similarly, the Commission chose a sequential electronic design for the auction of two DBS licenses, due to the lack of significant interdependence between the satellite channels available at the two discrete orbital locations.<sup>27</sup>

For the majority of the FCC auctions conducted since 1994, however, the Commission has used the simultaneous multiple-round auction. In every round, bidders can bid on any of the licenses being offered as long as they have applied for the licenses and have made an upfront payment sufficient for such licenses. Generally, the auction does not close until bidding has ceased on all licenses; that is, until a round goes by in which there are no new bids on any of the licenses. Use of this auction design took economic game theory from the laboratory to the marketplace.

The Commission chose a simultaneous auction with multiple-round bidding instead of sequential bidding because this method provides more information to bidders about the values of other licenses up for bid and the opportunity to use that information to aggregate licenses or to shift their bidding from one license to another. In addition, it reduces the impact of the winner's curse as described above. However, the simultaneous auction mechanism is effective only if appropriate rules such as stopping, withdrawal, and activity rules are utilized. The rules necessary for a simultaneous auction as developed by the FCC are shown in Box 5.

The Commission ultimately decided that simultaneous multiple-round bidding presented advantages of license aggregation and information disclosure that outweighed any disadvantages associated with administrative complexity.

Three full years of auctions experience has demonstrated that the features of the simultaneous multiple-round bidding auction, on balance, best meet the statutory objectives of efficient and intensive spectrum use, speedy implementation of new and improved services, and economic development and competition among service providers.

### **Major Features of the Simultaneous Multiple-Round Auction**

- (1) Interdependent spectrum licenses with the potential for substantial aggregation or substitution are grouped and sold at the same time.
- (2) All bidders submit bids over a sequence of rounds.
- (3) At the end of each round, the high bid for each license determines who would be the winner of that license if no higher bids were later received, and also helps fix minimum acceptable bids for the next round.
- (4) Bidders that fail to submit bids in a round and do not have sufficient standing high bids risk losing eligibility to submit bids in later rounds.
- (5) All licenses remain open for bidding until bidding has ceased on all licenses.

<sup>26</sup> See Implementation of Section 309(j) of the Communications Act - Competitive Bidding, PP Docket No. 93-253, *Fourth Report and Order*, 9 FCC Rcd 2330, 2332 (1994), *on recon.*, *Sixth Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd 19341 (1996).

<sup>27</sup> See Revision of Rules and Policies for the Direct Broadcast Satellite Service, IB Docket No. 95-168, *Report and Order*, 11 FCC Rcd 9712, 9785 (1995), *aff'd sub nom.*, *DIRECTV, Inc. v. FCC*, 110 F.3d 816 (D.C. Cir. 1997).

### 3. Implementing Spectrum Auction Theory and Design

Translating auction theory and design into practice was an enormous challenge for the Commission. Because the simultaneous multiple-round auction methodology had never been used before outside an academic laboratory, an auction system had to be built from the ground up to implement this new design. The Commission created a unique, state-of-the-art bidding system called the Automated Auction System ("AAS"). This complex database management system has revolutionized the assignment of licenses with its innovative use of information technology.

Using the AAS, the FCC can process tens of thousands of bids by hundreds of bidders on thousands of licenses. The system can process these bids instantaneously and generate round results within a few minutes following the conclusion of each bidding round. Bidders then use the results to determine their

#### **Box 4: Worldwide Interest in FCC Auctions**

There has been worldwide interest in both the Commission's simultaneous multiple-round auction design and its automated bidding system. Mexico licensed the FCC's copyrighted system and has already used it successfully in an auction. Guatemala has expressed strong interest in licensing the system and the Commission has demonstrated it to representatives of Argentina, Australia, Brazil, Canada, Hungary, Peru, Russia, South Africa, and Vietnam.

bidding strategy for the next round of the auction. The system also accommodates bidders by allowing them to bid remotely using a personal computer and a modem through a private and secure user wide area network. It can also accommodate on-site bidders and telephonic bidding. The AAS can manage both the administrative and technical aspects of the auction process with day-to-day operations that are simple and straightforward. With the AAS, the FCC has the ability to track auction participants from their initial inquiry through the auction bidding process.

The AAS was designed to operate using a small staff that monitors the fully automated processing of bids and results. This efficient system allows the FCC to do more with less and thus reduce administrative costs. The success of the system has not only been demonstrated in the FCC auctions but also recognized

by other countries, as shown in Box 4. The AAS has also received formal recognition by the Smithsonian Institution, which recently recognized the FCC for contributing to the information technology revolution.

Before the FCC could create an automated bidding system, however, it was necessary to develop operating procedures to ensure that the auctions ran effectively. Rules were developed to balance competing objectives. (See Box 5.) Some of the rules have been modified since the first auctions in 1994, reflecting the willingness by the FCC to adapt and improve its efforts. In some cases, the rules for particular auctions permitted discretionary adjustments to take into account circumstances that may develop during an auction.

With the implementation of these bidding rules, the overall operations of the auctions ran efficiently and smoothly. Whenever potential problems arose during the auctions, the FCC quickly addressed them with improvements to the auction mechanism. For example, when several bidders accidentally overbid by placing extra zeros in their bids in the broadband PCS C block auction and in the MDS auction, the FCC quickly modified its bidding system to make inadvertent erroneous bids less likely to occur.

**Box 5:**  
**Some Procedural & Policy Rules for the  
Simultaneous Multiple-Round Auction**

**Upfront Payment:** Upfront payments ensure that a bidder is sincere and financially prepared to win a license. It provides a bidder sufficient eligibility to bid upon licenses and entitles the bidder to a certain number of bidding units. These units determine a bidder's eligibility to bid on licenses in the auction, round by round. The upfront payment is not attributed to specific licenses, but instead, defines the maximum number of bidding units on which the bidder is permitted to bid in any single round. At the close of the auction, the Commission applies the upfront payment towards the winning bid amount, or other payments in the event of withdrawal or default. If a bidder does not win any licenses and has no withdrawal payments, then the upfront payment will be refunded.

**Activity:** To ensure that the auction closes within a reasonable period of time, an activity rule requires bidders to participate actively throughout the auction, rather than waiting until the end. A bidder's activity level in a given round is the sum of the bidding units associated with licenses (1) on which the bidder is the standing high bidder from the previous round; and (2) on which the bidder submits an acceptable bid in the current round. The minimum required activity level is expressed as a percentage of the bidder's maximum bidding eligibility (as determined by the upfront payment), and increases as the auction progresses through three bidding stages toward its conclusion. A bidder that does not satisfy the activity rule loses bidding eligibility. However, bidders generally are provided with five activity rule "waivers," which allow them a limited ability to maintain eligibility without violating the activity rules.

**Withdrawals:** In any given round, the firm which submits the highest bid on a license above the minimum acceptable bid becomes the standing high bidder for that license. If no higher bids are received for that license before the end of the auction, that firm acquires the right (as well as the commitment) to purchase the license at the price of the bid. However, firms also have the option of withdrawing high bids before the close of the auction. In such cases, the bidder generally will be subject to a withdrawal payment equal to the difference between the amount of the withdrawn bid and the license's final winning bid. No withdrawal payment is assessed if the subsequent winning bid exceeds the withdrawn bid.

**Stopping Rule:** Given the simultaneous bidding format, it is important to decide when the auction is over. In a sequential auction, where licenses are offered one at a time, bidding is over when no bidder raises the current high bid on the available license. In the simultaneous multiple-round auction, however, there are many different licenses for sale at the same time. The simultaneous multiple-round bid auctions conducted so far at the Commission have not closed until bidding activity stopped on all licenses.

Specifically, an additional safeguard was installed in the software that warns bidders if their bid amount is well in excess of the minimum bid for the round. This safeguard has worked effectively, and there have been no more inadvertent overbidding mistakes in auctions conducted since its implementation. The FCC continues to monitor each specific auction for further ideas to improve its auctions process.

Most recently, the Commission initiated a rulemaking that is designed to establish a common set of competitive bidding rules for all auctionable services. In the auction rewrite proceeding, the Commission sought comment on a range of design and implementation issues, including alternative bidding methodologies, electronic filing and bidding, as well as other matters. In this proceeding, the Commission proposes to create a common set of auction rules and procedures that are flexible and can be used for all services.<sup>28</sup>

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<sup>28</sup> See Part I Order, *supra* fn 6.

**V. Evaluation of the Auctions**

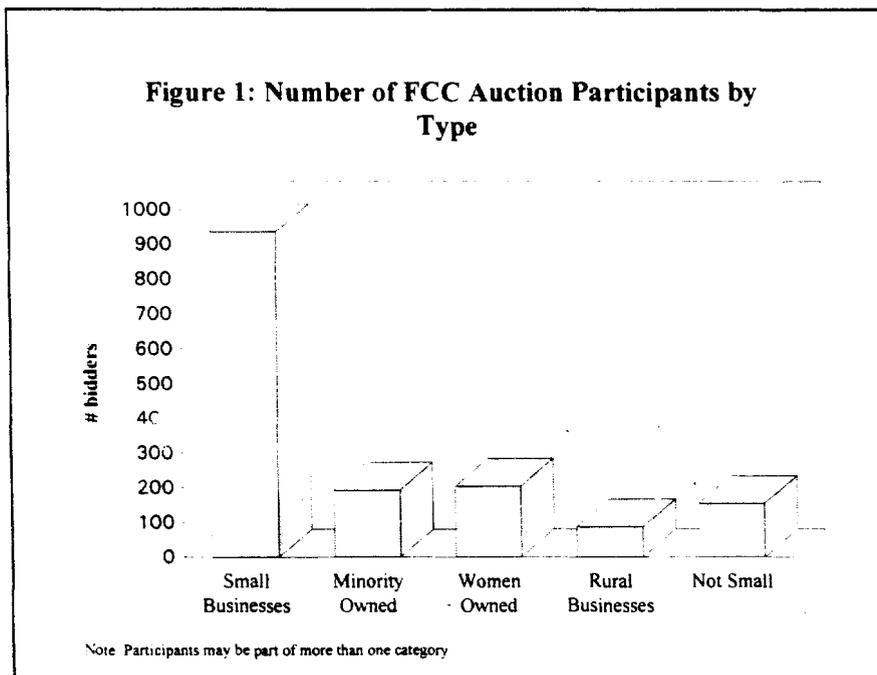
When Congress authorized the Commission to assign spectrum licenses using competitive bidding, it required the Commission to promote the development and rapid deployment of new technologies, products and services for the benefit of the public, including those residing in rural areas, without administrative or judicial delays. Congress also required the Commission to promote opportunity and competition by avoiding excessive concentration of licenses and by disseminating licenses among a wide variety of applicants, including small businesses, rural telephone companies, and businesses owned by members of minority groups and women (referred to as "designated entities").

*GTE observes that "the mechanisms established for registration, bid entry, and the downloading of the results of each round generally worked very well. The tools made available by the Commission's processes provided ample opportunity for monitoring and feedback to allow bidders to develop their strategies for subsequent rounds."*

Source: GTE Comments filed in response to *Public Notice*, FCC 97-232, at 14-15 (August 1, 1997).

Overall, the Commission believes that its auctions have successfully met the goals mandated by Congress

and in some instances may have exceeded expectations. As Figure 1 illustrates, auction participants were diverse. A significant number of those who won spectrum licenses were designated entities. As shown in Figure 4, 484 out of a total of 608 license winners were designated entities.



**A. Spectrum Auctions Compared to Alternative Methods**

The FCC auctions operated smoothly and assigned spectrum licenses in an economically efficient way. The Commission believes that in most cases spectrum auctions more

effectively assign licenses than past FCC license assignment methods. Although some critics complain that "[p]articipation in a Commission auction imposes substantial costs on bidders, especially small rural telephone companies and small businesses,"<sup>29</sup> past methods such as comparative hearings and lotteries

<sup>29</sup> RTG Comments filed in response to *Public Notice* FCC 97-232, at 24 (August 1, 1997).

have been more inefficient and resource intensive. Moreover, auctions have generally reduced the time to award licenses. For example, under comparative hearings, the average number of days, from application to grant of construction permit per cellular license, was 720 days. Similarly, under the lottery system, the average number of days per cellular license, from application to grant of construction permit, was 412 days. To date, the average number of days for FCC auctions, from the filing of an application to license grant, is 233 days. Appendix E provides more detailed information.

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*[L]ooking at the big picture of spectrum auctions, one can only view the FCC's auction program as a raging success."*

Source: John M. Bensché, *Hobson's Choice*, Bensché-Marks Vol. 97-16, Equity Research - Wireless Services, Lehman Brothers, September 29, 1997.

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Under the lottery system, the FCC sustained a flood of license applications because some lottery applicants submitted speculative entries with uncertain intent of building out a service. Many lottery winners resold their licenses in secondary markets. One speculator spent \$5 million on licenses to be resold in a year and a half for \$34 million without building so much as an antenna.<sup>30</sup> The costs associated with these resale transactions, such as those for cellular licenses in 1991, have been estimated at \$190 million.<sup>31</sup>

#### **B. The Simultaneous Multiple-Round Bidding Compared to Conventional Auctions**

The FCC also found that, for assigning licenses in most services, conventional auction mechanisms such as sequential multiple-round bidding or the sealed bid auctions were inadequate for assigning licenses to most services because they did not easily permit license aggregation or provide enough information to the bidder to achieve efficient results.

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*Auctions can be conducted at modest cost relative to license value. The total cost of all FCC auctions to date has been approximately \$74 million, which represents only about 0.62 percent of the total auction revenue raised to date.*

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In contrast, simultaneous multiple-round bidding generates more information about license values during the course of the auction and provides bidders with the most flexibility to pursue spectrum aggregation strategies. Thus, this methodology effectively awards interdependent licenses to the bidders who value them most highly. Generally, the Commission has found that because of the superior information and flexibility simultaneous multiple-round bidding provides, it is likely to promote efficient spectrum use in several ways. First, simultaneous multiple-round auctions rapidly award licenses to those who value it the most. Second, the auctions facilitate

efficient spectrum aggregation across geographic areas and spectrum blocks. For example, a bidder can bid with the goal of aggregating those licenses that best allow it to use the spectrum and shift its strategy as the auction progresses, if its first choice of licenses becomes too expensive. Third, these auctions generate information about the value of spectrum for alternative uses.

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<sup>30</sup> See *Calhoun*, p. 132.

<sup>31</sup> See *PCS Tentative Decision*, 7 FCC Rcd at 5699 n.41.

### **Box 6: Number of Resales: A Good Indicator of Efficiency**

Overall, the incidence of resales following spectrum auctions has been fairly low. For example, only one narrowband PCS license valued at 5 percent of the total narrowband revenues was transferred in the period between the auction and October 1996. Following the broadband PCS A and B block auction, 12 licenses worth 6.5 percent of total revenues and 6.6 percent of total population were resold in 1996. These 12 resales were small in number compared to the 75 resales in 1991 of cellular licenses distributed by lottery.

Evidence from both the narrowband PCS and the broadband PCS A and B block auctions suggests that the FCC efficiently distributed spectrum resources. If the distribution of licenses following an auction is efficient, there is little incentive for firms to resort to a secondary market to reallocate the licenses after the auction has concluded. In other words, the volume of license resales can be used as an indicator of economic efficiency. As Box 6 illustrates, resale of auctioned licenses has been low.<sup>32</sup>

### **C. Fostering Innovative Spectrum Use and Encouraging New Companies to Enter the Telecommunications Market**

FCC auctions, such as the broadband PCS spectrum auctions, resulted in the creation of many new wireless telecommunications companies.<sup>33</sup> Indeed, 53 percent of the licenses awarded thus far by auctions have gone to small businesses, many of which are new entrants in the telecommunications market. Also, several of the largest telecommunications enterprises, such as Sprint Telecommunications and the Bell Operating Companies, have formed alliances to establish nationwide PCS networks.<sup>34</sup> For subscribers, these new firms represent new choices for improving wireless service at lower prices. GTE has observed that "despite

#### **Auctions Encourage Innovative New Entrants**

Airadigm Communications was the first broadband PCS C block licensee to launch service in Green Bay and Madison, Wisconsin. Airadigm has not only provided services to parts of rural America but it has also reached some of the most underserved Americans by joining into a partnership with the Chillicothe Native American tribe, which plans to provide cutting edge wireless local loop service on the tribe's reservation.

Other new entrants that have been able successfully to use their radio spectrum licenses to offer innovative new services nationwide include Mobile Telecommunications Technologies Corp., which has launched its two-way paging narrowband PCS-based "SkyTel" service in 262 cities across the nation.

<sup>32</sup> FCC rules previously allowed no transfers or assignments of entrepreneurs' block licenses in the first three years after licensing, permitted transfers and assignments from entrepreneurs to entities qualified as entrepreneurs in years four and five, and allowed transfers and assignments with no restrictions after year five. The Commission later modified this rule -- for both the C and F block licenses -- to permit transfers and assignments of entrepreneurs' block licenses to other entrepreneurs during the first five years after license grant. See Amendment of Parts 20 and 24 of the Commission's Rules - Broadband PCS Competitive Bidding and the Commercial Mobile Radio Service Spectrum Cap, WT Docket No. 96-59, *Report and Order*, 11 FCC Rcd 7824, 7863 (1996).

<sup>33</sup> *Duesterberg & Pitsch*, p. 6.

<sup>34</sup> *CBO Study*, p. 20.