



## SUMMARY

The 700 MHz auction is positioned to serve communications policy goals of historic proportions. The service rules suffer from several key impediments that Frontline Wireless will address on reconsideration. But the auction rules addressed in these comments will also have a major impact on whether the Commission's and Congress's policy goals are effectively implemented or undercut and thwarted.

*First*, the Bureau has proposed reserve prices that are arbitrary, unsupported by the record, and irrational in that the methodology used to reach them do not reflect the goals stated in the *700 MHz Order*. More importantly, the proposed reserve prices are filled with potential for causing a failed auction. Set at this high level, the prices will depress bidder interest and, coupled with the re-auction proposal, will incentivize strategic behavior by those who want this auction to fail, and thereby jettison the open access requirements and public safety sharing requirements. The proposed reserve prices are too high because, among other reasons, they fail to take into account their special requirements. Most glaringly, the shared public/private network for public safety's benefit will easily cost \$5 billion more for the D Block licensee to construct than a comparable commercial network; yet the Bureau proposes to discount the reserve price for the D Block by only \$400 million. As the attached economist paper shows, the proposed reserve prices also ignore the massive global credit debacle of the last two months, which is widely acknowledged to have long-term consequences for the market. Indeed, an increase of just 3% in the cost of capital shrinks the present value of future spectrum earnings from \$5 billion to \$2.5 billion. These problems could be answered by dropping the reserve prices in this auction to levels that worked in past auctions – a fourth to a fifth of the current amount.

Second, the Bureau should recognize that package bidding on the C Block regional licenses and bidding on the national D Block license will be seen by some parties as substitutes. Accordingly, the activity rule should be modified, as detailed in the attached Cramton Rosston et al. paper, to facilitate bidders being able to move between the two blocks. This will serve the public interest in an efficient auction.

Third, the auction must be conducted fairly and without collusion. Both the Commission and the Department of Justice have recognized the importance and complexity of this challenge. As it has in the past, the Commission should promptly provide public warning that:

- the antitrust prohibitions against bid rigging and bid signaling apply now – before the Commission’s anti-collusion and anonymous bidding rules become effective;
- bid signaling can be effectuated not only between bidding parties but also through unilateral public statements by one bidding party or through non-complicit third-party conduits, including Commission personnel, the press, and financial analysts;
- potential bidders with market power must exercise special care about bid signaling because of their greater ability to distort the bidding process; and
- the Commission will refer any suspicious evidence of collusion, bid rigging or bid signaling to the Department of Justice, which is empowered to impose criminal penalties.

Finally, the Commission's traditional concerns regarding spectrum concentrations in highly consolidated markets should guide its auction procedures here. Therefore, it should require as part of the short-form application process that applicants disclose whether, if they won the licenses in question, their spectrum holdings in any specific market would encompass 70 MHz or more of CMRS spectrum. If so, that bidder should be disqualified from bidding for the license in question. Requiring subsequent divestiture as an alternative would not be sufficient; the results of the auction would already have been distorted, perhaps for anti-competitive reasons and with anti-competitive consequences.

With these critical modifications and complementary Commission actions, the auction rules can truly facilitate the critical Commission and Congressional goals for this spectrum auction.

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**Before the  
Federal Communications Commission  
Washington, DC 20554**

In the Matter of )  
 )  
Competitive Bidding Procedures ) AU Docket No. 07-157  
for Auction 73 )

To: Wireless Telecommunications Bureau

**COMMENTS OF FRONTLINE WIRELESS, LLC**

**INTRODUCTION**

The Wireless Telecommunications Bureau’s (“Bureau”) role in this proceeding is to establish rules that serve multiple objectives: implementing the Commission’s recent *700 MHz Second Report & Order*; ensuring a fair and efficient auction; complying with the guidelines of Section 309(j); and advising bidders of their legal obligations, under FCC rules and applicable antitrust laws, before and during the auction.<sup>1</sup> The proposed rules set out in the Bureau’s Public Notice (“*Auction Rules Public Notice*”) will not enable the Commission to achieve those important goals. To provide the Commission with concrete suggestions on how to amend the proposed rules to meet these critical objectives, Frontline submits these comments along with the attached white paper by a team of noted economists and auction experts (Peter Cramton, Gregory Rosston, Andrzej Skrzypacz, and Robert Wilson (hereinafter “Cramton Rosston Paper”)) to assist the Bureau in designing rules and procedures that ensure these

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<sup>1</sup> Second Report and Order, *In the Matter of Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band*, WT Dockets No. 06-150, PS Docket No. 06-229 *et. al.*, Aug. 10, 2007 (“*700 MHz Order*”).

statutory requirements and the Commission's own goals for the 700 MHz spectrum auction are met.

**I. RESERVE PRICES ARE TOO HIGH TO ACHIEVE THE COMMISSION'S GOALS AND ARE ARBITRARILY SET.**

The reserve prices set forth in the *Auction Rules Public Notice* are unprecedentedly and irrationally high, and more importantly, counter-productive to the objectives the auction seeks to achieve. As the Cramton Rosston Paper explains in detail, in past auctions the Commission has successfully used much lower reserve prices, set by calculating the social opportunity costs, to establish a price below which a license would not be granted. In the present case, the reserve prices are being used for a radically (and as Frontline has shown, illegally<sup>2</sup>) different purpose: to determine the market "cost" of the *public interest* conditions the Commission has placed on the spectrum to be auctioned, and to trigger a re-auction in the event the auction revenues do not jibe with the putative "cost" of the *public interest* obligations. The new reserve price rationale — aside from blatantly violating Section 309(j)(7), which states that financial considerations cannot drive auction decisions — will directly frustrate the Commission's objectives for this spectrum and this auction.

High reserve prices are contrary to auction theory, as well as Commission policy. The Cramton Rosston Paper shows that a reserve price can increase revenues where the valuation each bidder assigns to the asset to be auctioned is uncertain and there is a large gap between the valuations of the two highest bidders. If the reserve price is higher than the second-highest

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<sup>2</sup> See Frontline Reply Comments, WT Docket No. 06-150, at 38 (citing 47 U.S.C. § 309(j)(7)).

bidder's valuation of the asset, the highest bidder's first and winning bid is at the reserve price.<sup>3</sup> In this auction, however, the Commission has set a reserve price so high that the highest bidder's incentive is always to bid *below* the reserve, since the inviting prospect of re-auctioning unencumbered spectrum with no service conditions and possibly a lower reserve price (or no reserve price at all) — is dependent on the reserve price in the first auction not being met.

Moreover, the Bureau has set a reserve price for each block based not on calculating the seller's opportunity cost of alternative uses or deferring sale, as it did in the AWS auction. Instead, without justification, it based the reserve price on the "estimated market value" of the *winning bidder's bid* in what it assumes was a "comparable auction." The Cramton Rosston Paper demonstrates that establishing reserve prices for an entire block rather than license-by-license also frustrates Commission revenue-based objectives. High reserve prices will create incentives for bidders to assure that a re-auction will be necessary and thereby attempt to win spectrum unencumbered by conditions the Commission has found to be in the public interest. They will hold back bids in the initial auction to prevent the reserve from being met. They will withhold higher bids until the re-auction when there will be weaker service rules, an altered band plan, and fewer competing bidders.<sup>4</sup> These strategic incentives for major bidders to suppress their initial auction bids will be fatal to the Commission's policy goals for this spectrum. Presumably, the Commission's theory is that a re-auction will allow the licenses to bring in their true market value. But if the proposed auction rules are adopted, the result will likely be a re-auction price that is even *further* from estimated market value than the reserve

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<sup>3</sup> See Cramton Rosston Skrzypacz and Wilson Paper as Attachment A (hereinafter "Cramton Rosston Paper") at 11-12.

<sup>4</sup> As the Cramton Rosston Paper explains, a losing bidder in the first auction is much less likely to participate in the re-auction after previously having been outbid. See the Cramton Rosston Paper at 8, 12.

prices for the initial auction. Therefore, the auction rules as currently proposed create structural incentives to avoid bidding up to the fair value of the spectrum.

In its *700 MHz Order*, the Commission plainly recognized that there is a regulatory cost for the conditions it placed on the C and D Blocks – a cost borne by the license winner, but also a benefit that would inure to the public in the form of public interest benefits. Yet it set as a reserve price the full cost of the C Block, and a full cost minus 25 percent for the D. As to the C Block, the result of this spurious reasoning is that the license winner that pays the full commercial price if the reserve is met pays the full commercial price, *plus* the regulatory cost – even where there is no showing that the C Block licensee would enjoy any benefit from that regulatory cost. The only rational way to set a reserve price for the C Block is to begin by taking account, or at least attempting to approximate, this regulatory cost. The Commission has made no effort in that regard.

In addition, the particular method the Commission used to establish the “commercial price” upon which the reserve prices are based – relying on the market value of “comparable” spectrum offered in the AWS auction – relies on serious factual inaccuracies and therefore is arbitrary and capricious. The Commission admitted in its *700 MHz Order* that winning licensees will have “significantly more stringent performance requirements” than previous auction winners.<sup>5</sup> This factor alone will depress bidder valuations.

The reserve price for the D Block is especially arbitrary and unreasonable since the buildout, service and reliability requirements of the public/private partnership on that band are, by any reasonable calculation, a far greater expense than the capriciously selected \$400

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<sup>5</sup> *700 MHz Order* ¶ 153.

million the Bureau has used in discounting the D Block reserve price. As shown in the attached Technical Appendix, the difference in required land mass coverage alone between the AWS spectrum's "substantial service" 75% population requirement and the D Block's 99.3% population coverage requirement *is greater than 570%*. The cell tower build associated with the D Block coverage benchmarks, combined with the requirements that D Block base stations be hardened to ensure operation during national disasters, will likely cost well in excess of \$5 *billion* above what a purely commercial network would cost — an amount borne by *any* D Block licensee, whether an incumbent with an already existing network like Verizon or a new entrant like Frontline. The reserve price discount for the D Block, in other words, is about 8% of the conservative incremental capital cost that the D Block licensee will incur to fulfill its FCC-imposed coverage requirements.<sup>6</sup> By ignoring this evidence in the record as to what a D Block network might actually cost and instead setting an arbitrary reserve price reduced by an arbitrary amount, the Commission is in effect asking the bidder to agree to a price (the cost of the license plus the cost of meeting the unknown demands of public safety) without knowing what that price in fact is. That is more than doubly arbitrary; it is the height of caprice.

Spectrum prices are also not comparable across time. The price that will be paid for a house in 2008 will likely be quite different than the price paid for a similar house in 2006. The cost of borrowing money, state of the capital markets, buyers' view of the economy and their capacity to pay all fluctuate with the passage of time. The global collapse of the credit markets in recent weeks is being felt acutely in the telecom sector. Not surprisingly, projections for the wireless industry are all trending down. *See, e.g., Morgan Stanley, Telecom Services:*

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<sup>6</sup> *See* Technical Appendix at Attachment B.

*Deteriorating Wireless Trends, Revisited* (Jan. 18, 2007) (“we believe we are now seeing clear signs of a permanent slow down ... increasing competition for new subscribers will separate the winners from the losers, but has negative implications for all traditional wireless carriers”); CIBC, *2007 Wireless Industry Update* (Aug. 10, 2007) (“we expect disappointing fundamental results in 2008-09”); Morgan Stanley, *Telecom Services: Deteriorating Wireless Trends, Revisited* (Aug. 24, 2007) (“The telecom sector appears to be struggling to maintain its outperformance of recent quarters. Several of the pillars of recent strength are showing signs of weakness.”).

The impact of increases in the cost of capital on the spectrum auction cannot be overstated. As the Cramton Rosston Paper explains, raising the cost of capital a mere three percentage points, from 12% to 15%, “decreases the net present value by nearly 50%, i.e., from \$5 billion to \$2.5866 billion,” of the revenues expected to be earned from a spectrum license.<sup>7</sup> In short, “a rise in the cost of capital has a magnified effect on a firm’s valuation of a license.”<sup>8</sup> Therefore, it would be arbitrary and capricious to value future spectrum based on auction results from last year when market conditions were substantially more bullish.

The Cramton Rosston Paper sets out several alternative methodologies for calculating the reserve prices for the 700 MHz auction at pages 15–17. These methodologies would (1) be more consistent with the reserve pricing methods the Commission has followed in the past, and (2) lead to vigorous bidding and increased revenues to the Treasury.

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<sup>7</sup> See Cramton Rosston Paper at 5.

<sup>8</sup> *Id.*

## **II. THE BUREAU SHOULD MODIFY THE BIDDING PROCEDURES TO ENSURE THE FLEXIBILITY TO BID ON SUBSTITUTABLE LICENSES.**

The Commission's activity rule rightly forces bidders to be active throughout the auction. The Cramton Rosston Paper explains that the activity rule prevents bidders who are interested in multiple licenses from taking a "wait and see" approach in allowing other bidders to set valuations for those licenses, then deciding which licenses to acquire.<sup>9</sup> Where licenses in an auction are valued equally, the activity rule performs this function well. However, here the size of a package bid for the C Block license includes more than twice the megahertz as the next largest license, the D Block (22 vs. 10), and bidding on the C Block package therefore counts significantly more for a bidder's auction activity measure under the rule, even though some bidders may see each of the D Block and C Block packages as providing the licenseholder with a national footprint and are therefore in many ways substitutes.<sup>10</sup> Under the proposed rule, a bidder would be significantly penalized for alternating bids between the two licenses because the activity rule offers less credit for D Block bidding activity, even though the package bidder may find the blocks to be generally substitutable.

To ensure maximum efficiency and allow bidders to go freely back and forth between auctions for the generally substitutable D Block and C Block packages, the Bureau should revise the activity rule, as set out in detail in the Cramton Rosston Paper.<sup>11</sup> This modification will ensure that moving one's bidding to the D license should not irreversibly

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<sup>9</sup> See Cramton Rosston Paper at 19-20.

<sup>10</sup> As stated, the D Block and C Block package are the only opportunity for a new entrant to win sufficient licenses to develop a nationwide wireless service. In addition, even though the D Block only offers a license for 10 MHz, when combined with preemptible commercial use of the NPSL's spectrum, the amount of available spectrum capacity for the D Block licensee will be similar to that afforded to a C Block package winner.

<sup>11</sup> See Cramton Rosston Paper at 20-21 (stating that for activity rule purposes, the MHz-pops on the D block should include the MHz from the PPSL license, thus making it count as 22 MHz, the same as the C Block package).

prevent bidding on the C package. More bidders bidding on more blocks will increase auction revenues.

### **III. THE COMMISSION MUST TAKE SPECIFIC ACTIONS TO ENSURE ALL PERSONS COMPLY WITH FCC RULES ON COLLUSION AND APPLICABLE ANTITRUST LAWS.**

The Commission has an obligation under Section 309(j)(3) of the Communications Act to conduct an auction that “promote[s] economic opportunity and competition,” “avoid[s] excessive concentration of licenses,” and “recover[s] for the public a portion of the value of the public spectrum resource . . .” 47 U.S.C. § 309(j)(3). The Commission’s *700 MHz Order* took important steps to accomplish those goals, and the auction rules must be designed to achieve — and not undermine — those objectives. Two issues need to be addressed so that the auction serves those two vital purposes: (1) prevention of bid rigging, a *per se* antitrust violation under Section 1 of the Sherman Antitrust Act, by guarding against bid signaling (advertent or inadvertent, including through third parties and Commission personnel); and (2) prevention of undue concentration of spectrum by parties who already hold so much spectrum in specific markets that adding to it would violate Commission and Justice Department precedent against excessive spectrum aggregation, market by market.

#### **A. Meaningful Anonymous Bidding Is Essential To A Fair And Efficient Auction, And The Bureau Also Needs to Address the Risk Of Pre-Short Form Collusion.**

Following the important principles recognized in its *700 MHz Order*, the *Auction Rules Public Notice* agrees with the majority of commenters in concluding that anonymous bidding for this auction is in the public interest. As the *Order* recognized, bid signaling is a particular concern where, as here, incentives exist for incumbents in multiple-block spectrum auctions to depress auction prices by sending signals designed to keep new entrants or other

incumbents from bidding.<sup>12</sup> These concerns are not new. The Department of Justice emphasized them in the AWS auction proceeding just last year:

A goal of the FCC in designing rules [] should be to limit the opportunities for tacit collusion. This is especially true in an industry with a small number of players who recognize that bidding up spectrum prices is not necessarily in their interest in an auction where multiple blocks of spectrum are offered during successive rounds of bidding. ... less opportunity for smaller bidders to compete for certain licenses [would likely result in] loss of competition[,] lower government auction revenues and potentially less efficient allocations of markets among bidders.

*See DOJ Ex Parte, Comment Sought on Reserve Prices or Minimum Opening Bids and Other Procedures in the AWS Auction*, DA 06-238 (Mar. 3, 2006). Lack of anonymity also allows targeting of new entrants by incumbents: an incumbent would bid against a new entrant to prevent the development of a new competitor, but not bid against an existing competitor.

Without anonymity, new entrants are less likely to participate, and auction revenue is lower as a result. As it did in its comments in the 700 MHz proceeding, Frontline fully supports the Commission's establishment of effective anonymous bidding procedures.

The proposed rules, however, fall short of being fully effective because they fail to consider actions by the bidders themselves. The proposed rules would not on their face prevent a bidder every afternoon at 5 pm during the auction issuing a press release announcing its bids for that round. As the economists explain in the attached Cramton Rosston Paper, these or similar actions could undermine the importance of anonymous bidding, because those disclosing the information would be those most interested in intimidating or shaping the bidding behavior of others.<sup>13</sup> Accordingly, the Bureau should take two steps to make the anonymous

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<sup>12</sup> *See 700 MHz Order* ¶ 275 (anonymous bidding “mak[es] it harder for existing providers to identify and impede the efforts of potential new entrants to win”).

<sup>13</sup> *See Cramton Rosston Paper* at 21-22.

bidding requirement more effective. First, it should adopt an auction rule that states a bidder cannot release any bidding information to the public during the course of the auction.<sup>14</sup> This would be the most straightforward means to address this serious concern. Second, the Bureau could explicitly place all parties — bidders, their consultants, Commission personnel and other unintended conduits of bid-signaling information — on notice that communications during the auction will be subject to the antitrust laws and that the Commission will refer to the Justice Department for further investigation any evidence of unlawful activity.

The rules on anonymous bidding are important to curb bid signaling, a tool that can be used to accomplish the *per se* unlawful act of bid rigging, which can involve not only agreements on prices to be bid, but also agreements not to bid. The FCC’s anonymous bidding rules only prohibit potentially illegal attempts to signal bidding strategy *after* the auction process is launched with the filing of the short form auction applications. The Bureau’s proposed rules fail to address the equally serious concern about bid signaling by entities with market power that takes place *before* the short form is filed. If incumbent wireless providers are able to scare off other potential bidders by demonstrating a coordinated plan to block entry by aggressive bidding for spectrum needed by new entrants, their task is complete prior to the initiation of the Commission’s ban on communications related to auction strategy. Frontline urges this Commission, as past Commissions have done, to address this issue head-on and aggressively to remind parties with market power that they have obligations under antitrust laws that apply

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<sup>14</sup> The rules of course should not be interpreted to bar a bidder from releasing bidding information to its investors or potential investors during the course of the auction. In addition, the economics and auction experts make a strong argument as to why the anonymous rule, especially for small companies, should be lifted after the first auction if there is a “do over” on some other block. See Cramton Rosston Paper at 22-23.

before, during and after the short form and that a violation of the antitrust laws has serious consequences for those involved.

Pre-auction signaling by bidders that occurs after the auction short-form due date would plainly violate Commission anti-collusion rules. *See* Public Notice, *Wireless Telecommunications Bureau Clarifies Spectrum Auction Anti-Collusion Rules*, 11 FCC Rcd. 9645 (1995) (“*Anti-Collusion Notice*”) (“After the short-form filing deadline, applicants may not discuss the substance of their bids or bidding strategies with bidders, other than those identified on the short-form application. ... The post-deadline prohibition on discussions extends to providing indirect information that affects bids or bidding strategy.”) (citing 47 C.F.R. § 1.2105(c)(1)). However, as the Commission has emphasized in the past, antitrust laws *presently* in effect bar behavior aimed at reaching anticompetitive agreements on bidding strategy (even if it occurs prior to filing short form applications), which constitutes a *per se* criminal violation of the Sherman Act:

[U]nder the antitrust laws, the parties to an agreement may not discuss bid prices if they have applied for licenses in the same geographic market. *In addition, agreements between actual or potential competitors to submit collusive, non-competitive or rigged bids are per se violations of Section One of the Sherman Antitrust Act.*

*See id.* (emphasis added); *see also* Public Notice, *Wireless Bureau Responds to Local Multipoint Distribution Service Auction Questions*, 13 FCC Rcd. 341, 347-48 (1998) (“Public statements can give rise to collusion concerns. This has occurred in the antitrust context, where certain public statements can support other evidence which tends to indicate the existence of a conspiracy.”) The 1995 Public Notice is attached as Attachment C and can serve as a model for the necessary notice in this proceeding.

The fact that bidders might be communicating information related to bidding strategy in the context of a presentation to a government official does *not* immunize them from

antitrust scrutiny. The *Noerr-Pennington* doctrine only applies to conduct designed to influence the passage or enforcement of laws; it does not provide a shield against bid signaling activity prior to an auction, even if it is dressed up as lobbying.<sup>15</sup> Similarly, statements to the press or Wall Street or industry analysts cannot be used as cover for, or a mechanism to perpetrate, bid-signaling. Absent a legitimate, pro-competitive need to publicize what in normal circumstances would be considered highly-confidential and proprietary information, any public statements regarding bidding intentions should cause grave concern at the Commission and the Department of Justice.

Concerns about bid signaling apply with special force to a bidder or potential bidder that already holds substantial market power in the affected markets.<sup>16</sup> Any incumbent provider with substantial spectrum holdings across multiple geographic areas, and any persons dealing with those entities, needs to be especially watchful to avoid any conduct that could be construed as bid signaling, since they have an obvious motive to communicate bidding information to each other, i.e., preventing a new entrant from entering the market. The incumbents likely to participate in this particular auction, Verizon and AT&T, compete nationally today for customers, and have competed consistently in auctions for many years. They own about 40% of all spectrum below 1GHz, and together own about half of all CMRS spectrum. For the same reason, such entities have to be especially careful about discussions with other potential bidders, and about statements in public or private indicating their interest (or lack thereof) in particular spectrum blocks. As noted above, *per se* illegal bid-rigging need not take

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<sup>15</sup> See *California Motor Transport v. Trucking Unlimited*, 404 U.S. 508, 513 (1972).

<sup>16</sup> Cf. *Continental Airlines, Inc. v. American Airlines, Inc.*, 824 F. Supp. 689, 704 & n. 38 (S.D. Tex. 1993) (discussing size of market share of alleged conspirator).

the form of an explicit agreement on bid levels. Agreements regarding which licenses to bid on or how aggressively to pursue a particular bidding strategy can have the same anticompetitive effects of a naked agreement on bid levels and are similarly illegal under Sherman Act § 1.

The Commission in the past has made clear that, as an agency of the Executive Branch, it has an obligation to assure enforcement of all laws.

To the extent the Commission becomes aware of specific allegations that may give rise to violations of the federal antitrust laws, the Commission may investigate and/or refer such allegations to the United States Department of Justice for investigation. Bidders who are found to have violated the antitrust laws or the Commission's anti-collusion rules in connection with participation in the auction process may, among other remedies, be subject to the loss of their down payment or their full bid amount, cancellation of their licenses, and may be prohibited from participating in future auctions.

*Anti-Collusion Notice*, 11 FCC Rcd. at 9646-47 (Attachment C). The Commission well serves all persons involved in the auction process — bidders, potential bidders, their consultants, Commission personnel, and the press and financial analysts (who could inadvertently be a conduit for disseminating unlawful information) — by alerting them to the serious consequences of antitrust violations and to the enduring and ongoing applicability of the antitrust laws to the auction process. The Bureau should take the same step here.

**B. The Commission's Obligation To Prevent Excessive Concentration In The Highly Consolidated Wireless Market, And Its Own Precedent, Require The Commission To Limit Any One Entity From Controlling 70 MHz Or More Of CMRS Spectrum.**

Both the Commission and the Department of Justice have guarded against the anticompetitive dangers of a single party aggregating excessive spectrum in a particular geographic market. While the Commission no longer has a hard cap on the amount of spectrum one individual licensee may hold, the Commission does factor into its competition analysis the amount of spectrum a single licensee holds in a particular market — particularly in a market already experiencing concentration. The fundamental premise underlying merger enforcement is

that increased levels of concentration are likely to give rise to anticompetitive effects. Where significant amounts of spectrum are becoming available, the Commission and Department of Justice must examine how further acquisitions of spectrum by entities that already control significant amounts of spectrum in a relevant geographic market will affect the continued development of competitive wireless services.

As the Commission stated in its July 2005 order analyzing the public interest impact of a potential merger between Alltel and Western Wireless Corp., transactions in “those markets in which the Applicants would have 70 megahertz or more in at least part of the market post-transaction” would receive increased scrutiny to determine whether such “a large enough share of the available spectrum” in a single entity was “such that other carriers may be constrained in the deployment of next-generation services.” *Alltel-Western Wireless Corp. Order*, 20 FCC Rcd. 13,053 (2005), ¶ 49. Consistent with the analysis undertaken by the Department of Justice under its power to review mergers pursuant to Section 7 of the Clayton Act, the Commission found that the consolidation of spectrum capacity over 70 MHz, coupled with the existing market power and other factors, was “likely to cause significant competitive harm.” *Id.* ¶ 162. As a consequence, the Commission joined the Justice Department in ordering divestiture of operating assets, including associated spectrum based on these circumstances.

This auction triggers similar concerns. As Frontline demonstrated in the 700 MHz proceeding, the measure of market concentration (“HHI”) in the wireless service industry at the end of 2005 was over 2,700 — well above the 1,800 figure that the Department of Justice finds to be highly concentrated.<sup>17</sup> Significant additional accumulation of spectrum by the largest

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<sup>17</sup> See Frontline Initial Comments, WT Docket No. 06-150, Exhibit 1 at § 3.1 (May 23, 2007).

wireless carriers in this auction, coupled with current market concentration, could cripple the ability of competitors to develop new services and cause serious competitive harm in the wireless market. The Commission has stated that it wants to promote competition into the market for wireless services. Competition requires multiple competitors, and allowing dominant players in highly concentrated markets to acquire additional spectrum will not be conducive to vibrant, competitive markets – by any measure one of the Commission’s goals for this spectrum.

Consistent with this precedent and its ongoing public interest obligations, the Commission should state in a Public Notice that it will reject any short form application from an entity that, if successful at auction, would amass 70 MHz or more of CMRS spectrum in any market already experiencing concentrated market power. To enforce this requirement, the Commission should require as part of the short-form application process that applicants disclose whether, if they won the licenses in question, their spectrum holdings in any specific market would encompass 70 MHz or more of CMRS spectrum. This step is necessary or else the auction process would be distorted by a participant that cannot obtain the license even if it is the high bidder.

The proposal to not accept short form applications from entities that would hold more than 70 MHz of CMRS spectrum is supported by several reasons. First, under Commission and DOJ precedent, it is not in the public interest for an entity to hold more than 70 MHz in a highly concentrated market where such an accumulation of spectrum will cause significant anticompetitive effects, and any additional spectrum should be subjected to divestiture. *See Alltel-Western Wireless Order, supra.* Second, the C Block with its 22 MHz license, which could push some incumbents well past 70 MHz, will be licensed in large spectrum geographic areas that encompass major urban centers such as New York, Philadelphia, Atlanta, Los Angeles,

Chicago and Houston, where the two largest incumbents already have substantial holdings.

Third, the D Block, with its national 10 MHz license, can *not* be disaggregated, pursuant to the Commission’s decision in the *700 MHz Order*, so post-auction disaggregation cannot be used to remedy an incumbent’s undue concentration of spectrum. *Fourth*, no more spectrum below 1 GHz will be available for the foreseeable future. Though the Commission has turned aside arguments calling for spectrum divestiture in the past based on the promise of more spectrum in the future, that reasoning cannot apply here.

For all these reasons, the Commission should make clear at the outset that it will not accept short form applications that would result in the applicant’s acquiring 70 MHz or more of CMRS spectrum in a particular geographic market, or grant licenses after the auction that violated that limit.

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The Commission also needs to correct the onerous effects of the D Block default penalty both on the reserve price and interested bidders. Parties with a strong interest in partnering with the Public Safety Broadband Licensee will be discouraged from bidding because the default provision creates powerful incentives for losing bidders to disrupt the process of the D Block high bidder and the PSBL negotiating a successful and commercially viable shared network agreement. Also, imposing a substantial financial penalty on the D Block auction winner for failing to reach an agreement with the PSBL will absolutely deter bidding of entities of all types, incumbents and new entrants alike. The D Block auction winner already has a powerful incentive to close the deal — access to 12 MHz of spectrum — and does not need the financial penalty to be motivated. The possibility of a deficiency payment that could well be calculated by the difference between an auction with many entrants and a re-auction with a

single bidder – *plus* an additional 15% – would make any rational entity think twice before bidding seriously on the D Block and committing to the NSA negotiation process with public safety. The risk of default for reasons entirely out of the auction winner’s control are far too great.

Consequently, the D Block default provision must be revised to make the D Block auction process and the subsequent shared network relationship workable. In short, the default payment provisions should either be eliminated, or the reserve price on the D Block should be set at a nominal amount to ensure the cost of risk is not so high as to frustrate bidding. Frontline will address this set of critically important issues in its petition for reconsideration in connection with the *Second Report and Order*, but it mentions the issue here because the ill effects of the arbitrarily high reserve price, the re-auction process and the default provision are mutually exacerbating and highly damaging to the Commission’s policy objectives.

## CONCLUSION

For the reasons stated herein, the Bureau should revise its auction rules and provide appropriate public notice to ensure that the statutory objectives of the Communications Act and the statutory obligations of the antitrust laws are adhered to by all persons before, during and after the auction.

Respectfully submitted,



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Jonathan D. Blake  
Gerard J. Waldron  
Enrique Armijo  
COVINGTON & BURLING LLP  
1201 Pennsylvania Avenue, NW  
Washington, DC 20004-1401

*Counsel for Frontline Wireless, LLC*

August 31, 2007

**Attachment A:**

**Comments on the FCC Wireless Bureau's Proposed  
COMPETITIVE BIDDING PROCEDURES FOR AUCTION 73**

**Peter Cramton, Gregory Rosston, Andrzej Skrzypacz, and Robert Wilson**

**Comments on the FCC Wireless Bureau’s Proposed  
COMPETITIVE BIDDING PROCEDURES FOR AUCTION 73**

(DA 07-3415, August 17, 2007; AU Docket No. 07-157)

**Peter Cramton, Gregory Rosston, Andrzej Skrzypacz, and Robert Wilson<sup>1</sup>**

August 31, 2007

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## Authors

*Peter Cramton* is Professor of Economics at the University of Maryland and Chairman of Market Design Inc. His research focuses on auctions and market exchange. Most of his recent work has addressed design and incentive questions in auctions. He has served as an auction expert for numerous companies in spectrum auctions and electricity auctions. He has advised the FCC and several foreign governments on the design and implementation of spectrum auctions. Cramton has designed electricity markets in New England, Colombia, France, and Belgium. He has published numerous articles on auction theory and auction practice in major journals. Cramton received his B.S. in Engineering from Cornell University and his Ph.D. in Business from Stanford University.

*Gregory Rosston* is the Deputy Director of the Stanford Institute for Economic Policy Research (SIEPR) and Deputy Director of the Public Policy program at Stanford University. His research is on telecommunications and competition policy. He served as Deputy Chief Economist of the Federal Communications Commission and was involved with the design and implementation of the FCC's original simultaneous multiple round auctions. In conjunction with the FCC, he has co-organized three conferences on package bidding design.

*Andrzej (Andy) Skrzypacz* is Associate Professor of Economics at the Stanford Graduate School of Business. His research is on microeconomic theory, especially information economics, market design, and dynamic games. His recent papers consider auction design, bargaining theory, repeated games, and collusion in markets. He received his PhD in Economics from the University of Rochester in 2000.

*Robert Wilson* is the Adams Distinguished Professor of Management, Emeritus, at the Stanford Business School, where he has been on the faculty since 1964. His research and teaching are on market design, pricing, negotiation, and related topics concerning industrial organization and information economics. He has been a major contributor to auction designs and competitive bidding strategies in several industries, including the original design of the FCC's simultaneous ascending auction.

The authors' curriculum vitae are attached as Appendix A.

## Summary

We comment on the FCC Wireless Bureau's proposed procedures for competitive bidding in Auction 73 (DA 07-3415, August 17, 2007; AU Docket No. 07-157).

Our primary concern is the role of the proposed aggregate reserve price for each of the five blocks in combination with provisions for prompt re-auction with weaker performance requirements if the reserve price is not met.

- Using reserve prices that are based on a comparison with the high bids for AWS licenses in Auction 66 in mid-2006 ignores the effect of altered conditions and increased volatility in capital markets when Auction 73 opens in January 2008.
  - Even a small increase in the cost of capital causes a large reduction in bidders' valuations of licenses. Continued tightness in the market for investment funds could itself cause failure of Auction 73 simply because reserve prices have not been adjusted to account for higher costs of capital.
  
- The use of aggregate reserve prices is new, other than the aggregate reserve price for Auction 66 that was less than 20% of the final gross of the winning bids and was based on a calculation of opportunity costs. The Bureau now proposes to use a different methodology than it did for Auction 66—and every previous auction—with no apparent justification.
  - The Bureau does not seem to have appreciated the threshold and free-rider problems engendered by aggregate reserve prices for entire blocks, nor the prospect that major bidders prefer that the reserve prices are not met so that there will be a re-auction with weaker service rules and diminished competition from losing bidders in the initial auction.
  
- The use of reserve prices gauged to presumed market value is contrary to the theory of optimal reserve prices when bidders' valuations have substantial components in common and the seller's objective is revenue maximization, and even more contrary when the objective is maximization of overall social benefit.
  - The Bureau's reliance on final bid prices in Auction 66 of the AWS licenses has several deficiencies that we describe in detail. Some of the major concerns are that the more stringent performance requirements in Auction 73 make Auction 66 a poor basis for comparison, and setting reserve prices equal to expected revenues is an untested and unjustified way to implement reserve prices.
  - The Bureau does not seem to have considered the effects of the reserve prices on efficiency and revenue in the initial auction, nor the likelihood that losing bidders in the initial auction will not bid in the re-auction because they know they have already been outbid and likely will be outbid again in the re-auction, which would drastically reduce competition and revenue in the re-auction.

- The Bureau does not seem to have appreciated the hazards of having two auctions in quick sequence with the same reserve prices and weaker performance requirements, and later a third auction if the initial reserve price is still not met.
  - The aforementioned threshold and free-rider problems are compounded because there is no incentive in the initial auction for high bidders to raise their bids to meet the aggregate reserve prices—since they can do so in the re-auction for licenses with weaker service rules, and/or an altered band plan, and less competition from bidders who are discouraged from bidding again after losing in the initial auction. The Bureau does not seem to have examined the strategic incentive for major bidders to suppress their bids to force a re-auction, nor their strategies for filings and appeals that could delay the re-auction.
  
- The Bureau has not clarified exactly what will ensue after a reserve price is not met in the initial auction, nor after it is again not met in the re-auction.
  - We are concerned about several ambiguities that we describe in detail, such as exactly who is eligible to bid in the re-auction. We do not find any provision in the Bureau’s rules that implements the Commission’s directive that the Wireless Bureau “propose and adopt procedures that give applicants an opportunity to obtain bidding eligibility specifically for the alternative licenses, in addition to the initial licenses.”
  - We are concerned that the Bureau does not commit to the extent and form of the package bidding that might be allowed in the re-auction (e.g., for C1, C2, and C in a three-level hierarchy), nor has the Commission committed to the license specifications.

In sum, we think that the Commission’s intent to make the initial auction a test may fail to achieve its purpose of proving whether the stringent performance requirements for the licenses in the initial auction still enable aggregate reserve prices to be met. Deficiencies in the auction design do not allow for a valid test of the cost of the provisions on the licenses.

We also comment on specific aspects of the bidding procedures. Among others:

- We observe that it is in the FCC’s interest as regards both efficiency and revenue to increase the degree of substitution among licenses. We propose an amendment to the activity rule to increase substitutability between license D and the package of 8 REAGs in block C.
  
- We suggest that the Bureau clarify and strengthen the rules regarding anonymity during the initial auction. But also we ask that a bidder who wins in the initial auction can ask the FCC to reveal this fact before the re-auction, since this revelation may be forced by accounting rules or necessary to meet financial commitments.

# **1. Unprecedentedly high aggregate reserve prices coupled with re-auction provisions**

In this section we discuss a major threat to the auction success caused by the interplay of three proposed elements:

- 1) Unprecedentedly and arbitrarily high reserve prices
- 2) Aggregate per-block reserve prices rather than license-by-license reserve prices
- 3) Provisions for a prompt re-auction with modified license rules and the same high reserve prices.

We express our concern that the reserve prices are too high, based on faulty comparisons with the prices in the AWS auction, and against the established and successful designs used by the Commission in previous auctions. We also see the imposition of reserve prices at the aggregate level of an entire block to be a major departure from previous practice that is very risky in itself, and worsened further by the free-rider problem that it creates for the bidders within each block. All of this is compounded by the prospect of a “prompt” re-auction of those blocks failing to meet their reserve prices in the initial auction, but with a different band plan and weaker performance requirements. The prospect of a re-auction may be a self-fulfilling prophecy because of the possibility that the aggregate reserve prices will discourage entry into the bidding and suppress bidding activity and prices in the initial auction.

Our comments are collected into three subsections. In the first we comment on those aspects affecting the efficiency of the license allocation and the government’s revenue. In the second we comment on vulnerabilities to strategic behavior. In the third we argue that the high reserve prices are contrary to established auction theory and the Commission’s practice. We finish this section by recommending a different calculation of the reserve prices.

## **1.1. *Effects of capital markets on bidders’ valuations***

In this section we criticize the Bureau’s proposed reserve prices because the comparison with the aggregate high bids in the auction of AWS licenses ignores subsequent volatility in capital markets. The Bureau assumes implicitly that conditions in capital markets and the wireless communications industry will be the same in early 2008 when Auction 73 begins as when Auction 66 occurred in mid-2006. Making this assumption runs a substantial risk that reserve prices exceed bidders’ valuations of the 700 MHz licenses. We state our argument in two parts. The first describes evidence that conditions in the capital markets have become less favorable for investments in new wireless businesses. The second describes the implications for bidders’ valuations of the licenses offered in Auction 73.

- Worsening conditions in the market for collateralized debt have spread widely in financial markets during recent weeks. The resulting tightening of credit markets could exclude more than one firm from obtaining financing from investors for entry on a national scale and reduce valuations for the licenses substantially. This is especially germane for the D Block license and the package of 8 REAGs in Block C. It is also widely recognized that the risk factors in Auction 73 are much greater than in the AWS auction. Higher risk is associated with the D Block license because it depends on a still-to-be-negotiated network sharing agreement with Public Safety, with the C Block because it has open access provisions that are entirely new in the wireless markets, and other licenses have more expensive buildout requirements based on geographical coverage. Investor advisory services have also published concerns about declines in subscription growth, market saturation, and intensified competition. To cite one example:
- "The telecom sector appears to be struggling to maintain its [performance] of recent quarters. Several of the pillars of recent strength are showing signs of weakness. Wireless and broadband subscriber growth is slowing significantly, while M&A synergies are becoming less material and industry consolidation appears largely over. ... The carriers cited market maturity as a factor in slower growth; wireless subs have now surpassed 80% of the population." [Morgan Stanley Telecom Services, "Deteriorating Wireless Trends Revisited, August 24, 2007]
- The second part of our argument is that a small change in the cost of capital changes greatly the valuation of a license. Recall that a bidder's valuation of a license is typically obtained by computing the "net present value" of the expected costs and revenues over many years into the future. The net present value is computed by discounting future costs and revenues by the firm's cost of capital, expressed as a rate of interest. The result of this calculation is very sensitive to the cost of capital. In the example analyzed below we illustrate this fact by assuming a realistic pattern of costs and revenues, and by supposing that the cost of capital increases from a rate of return of 12% to 15% per year due to tighter conditions in capital markets.

**Example of the effect of raising the cost of capital from 12% to 15%.**

Suppose that the total cost of buildout is \$5 billion and thereafter the net revenue is \$1.6156 billion per year. Suppose further that the costs of buildout are incurred in years 1, 2, and 3 in the amounts \$2 billion, \$2 billion, and \$1 billion, and that the stream of net revenues of \$1.6156 billion per year begins in year 4. One can then calculate that:

- 1) If the cost of capital is 12% per year then the net present value is \$5.0000 billion.
- 2) If the cost of capital is 15% per year then the net present value is \$2.5866 billion.

Thus in this example the three percentage point increase in the cost of capital decreases the net present value by nearly 50%, i.e., from \$5 billion to \$2.5866 billion. The effect of an increase in the cost of capital illustrated in this example is typical. In general, a rise in the cost of capital has a magnified effect on a firm's valuation of a license. Even for an established firm like Verizon and AT&T, its valuation of a license can be reduced due to altered conditions in capital markets.

In summary, we challenge the Bureau's reliance on high bids for AWS licenses in September 2006 as a standard against which to estimate valuations for the 700 MHz licenses offered in Auction 73 in early 2008. Relying on the outcome of a previous auction takes no account of altered conditions and volatility in capital markets in the interim, and risks failure of the auction simply because the reserve prices exceed bidders' valuations based on current costs of capital in 2008.

### ***1.2. Re-auction, threshold problem, and lowered revenues***

Until a block's aggregate reserve price is met, all bidders for every license in the block will be affected by uncertainty about whether their bids are "real" (since they are voided if the block is re-auctioned) and the license is "real" (since the performance requirements and/or block definition will change if the block is re-auctioned). Of particular importance will be the incentive of each bidder individually to bid minimally on specific licenses in hopes that other bidders on other licenses will volunteer to bid higher on those licenses to push the aggregate of all bids over the reserve-price threshold. That is, there is a free-rider problem among the bidders, which could result in lower revenue and/or failure to achieve the reserve price, even if the performance requirements for the licenses offered in the initial auction serve the public interest better than the performance requirements for the alternative licenses.

Thus the aggregate reserve price for each block creates a new "threshold problem" in which every player is hoping that others will increase their bids on other licenses to meet the aggregate reserve price. The higher the reserve price, the higher the probability players assign to the re-auction and hence the less incentive they have to bid aggressively in the current auction. It can lead to a situation where without the reserve price the bids would easily exceed the reserve price, but with the reserve price and the option for re-auction, the bids end up much lower in the initial auction. The situation is complicated further by the fact that no bidder will know if others are bidding seriously or not, i.e., whether the bidding shows genuine interest or just gaming of the system to force a re-auction.

We anticipate that if the aggregate of the high bids for a block fails to meet the reserve price in the initial auction and then again in the prompt re-auction with weaker performance requirements and the same reserve price, then surely the Commission will reconsider the matter. The likely outcome is that a 3<sup>rd</sup> attempt to auction the block is delayed substantially, and the reserve prices are lowered significantly and made specific to each license.

Our view is that there is a severe risk that this outcome will occur at least for some blocks. The reasons it might occur are intrinsic to the design of the auction and re-auction. Using standard game theory logic, one can work backward in time through the scenario to see the forces at work.

- For the 3<sup>rd</sup> auction the reserve prices would likely be license-specific after the repeated failure of the aggregate reserve price to be met. Because the use of an aggregate reserve price for each block induces a free-rider problem among the

bidders that might have been the cause of failure to meet the reserve price, the Commission would be amply justified in eliminating this feature in the 3<sup>rd</sup> auction. That there would be a substantial interval between the 2<sup>nd</sup> and 3<sup>rd</sup> auctions seems inevitable because the Commission and the bidders would both want a thorough reconsideration of “what went wrong” in the first two attempts to auction the licenses in the block.

- In the 2<sup>nd</sup> auction the bidders face the free-rider problem in meeting the reserve price. This problem is exacerbated by their assigning little importance to achieving the aggregate reserve price, because they anticipate that if it is not met then after some further delay there will be a 3<sup>rd</sup> auction with license-specific reserve prices.
- In the 1<sup>st</sup> auction the free-rider problem is equally severe, and it too is exacerbated by anticipation that the reserve price is unimportant, since failure to meet it merely initiates a sequence of one or two subsequent auctions, first with the same aggregate reserve price and then another with lower, license-specific reserve prices.

Thus, even in the 1<sup>st</sup> auction the bidders are affected by the prospect that eventually the Commission will reduce or abandon use of an aggregate reserve price for an entire block.

Further compounding the problem for the FCC is the prospect that competition will diminish with each successive auction. Each losing bidder (i.e., one who is not the high bidder on a license) has diminished hopes of eventually winning the license (since he has already been outbid) and therefore less incentive to bid in the next auction for the same license. Losing bidders in the 1<sup>st</sup> or 2<sup>nd</sup> auction can expect investors to withdraw after they see little prospect of eventually winning the license. For example, suppose that the bidding in the initial auction is vigorous for some licenses in a block, but because of little activity on other licenses in the block the aggregate reserve price is not met. If bidder 1 outbid bidder 2 on one of the active licenses in the initial auction, then in the re-auction it is doubtful whether bidder 2 will bid on this license since he was outbid previously.

This can be catastrophic for the government’s revenue – the eventual winner of a license need not pay more than the valuation of the 2<sup>nd</sup> highest bidder, but if there is no other bidder, then the government obtains only the reserve price. Seeing this, the high bidder for a license has no motive to raise his bid to help meet the aggregate reserve price for the block in the 1<sup>st</sup> and 2<sup>nd</sup> auctions. Thus the bids in all three auctions can end up much lower than if the auction started with a lower reserve price that all would expect to be exceeded.

We recognize that the Commission’s motive in choosing this auction design is to “test the market” to see whether the stringent performance requirements for the 1<sup>st</sup> auction’s licenses will nevertheless command prices comparable to the AWS auction, and if not, to re-auction with weaker requirements (and the same reserve prices) in the 2<sup>nd</sup> attempt. Our view, however, is that this test will likely fail, not because the conditions do not serve the public interest, but because the auction mechanics and do-over provision set up a test that most parties *want* to fail. The aggregate reserve prices are likely not to be met precisely

because the bidders anticipate the 2<sup>nd</sup> and 3<sup>rd</sup> auctions. The consequence would be a delayed and inefficient allocation of licenses with diluted performance requirements, delayed and reduced revenue for the government due to weakened competition, and overall a reduction in benefits for the public.

The Commission's Order offered no justification for applying reserve prices to the aggregate over all licenses in a block, nor apparently any awareness of the free-rider problem it engenders. Reliance on a re-auction was motivated by a "let the market decide" rationale because the Commission was uncertain about the effects of the licenses' performance requirements (geographical buildouts, and open platforms) even though these were judged to be in the public interest.<sup>2</sup> Unfortunately, this reliance on a re-auction can adversely affect the outcome of the initial auction, even to the extent of causing it to fail as bidders wait for the "real" auction that is the re-auction of all those blocks failing to exceed their aggregate reserve prices.

### **1.3. Strategic behavior in the two auctions**

In this subsection we remark on how the auction design allows various strategies that could undermine the initial auction.

We mentioned above a bidder's motive to "wait and see" if other bidders will drive the aggregate of a block's bids up to the reserve price for that block – this is the free-rider problem. The activity rule will of course encourage bidders to find ways to "wait and see" that maintain their eligibility, and the most likely of these will be an excessive proliferation of "parking" bids. Also prominent will be cautious bidding to see if failure of the C block to meet its reserve price will open a new array of C1 and C2 licenses without open platform requirements, with smaller bandwidth, and in the C1 block, licenses offered in each of the smaller 176 EAs rather than the larger 8 REAGs. All of these strategies will of course require a bidder to proceed on the basis of several layers of business plans – Plans A, B, C, etc.

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<sup>2</sup> In the 700 MHz Order (¶ 313), the Commission stated regarding the C block that:

The treatment of these licenses under such a reauction scenario, however, reflects our determination that the cost of the open platform requirements to wireless service providers – evidenced by the magnitude of the devalued bids – would reveal a significant problem with the requirements, such as a greater negative impact on network operations than we are predicting. As such, our assessment of the net public interest benefit of imposing these requirements (*i.e.*, the benefit of fostering the development of innovative devices and applications vs. the potential negative effects on network operations) changes. We believe that these circumstances, (*i.e.*, the failure of the auction results for conditioned C Block licenses to satisfy the C Block-specific reserve price) are unlikely to occur. But if they do, they provide sufficient evidence to conclude that we have weighed the public interest balance incorrectly, and that the cost of the open platform restrictions was too high – not because the auction would have failed to generate enough Federal revenue, but because the low level of bidding would indicate inherent problems with operating a wireless system under this type of open platform regime.

Unfortunately, failure to meet the C block reserve price could be caused by providing a re-auction with weakened service rules for all re-auctioned blocks. If offered the option of waiting for similar licenses with weaker service rules then most bidders would prefer to wait, thus obviating the initial judgment of the Commission that the stricter service rules are in the public interest, quite apart (as the law requires) from revenue considerations.

Our deepest concern, however, is that some bidders will employ strategies intended directly to ensure that a re-auction is necessary. Particularly vulnerable are the C and D Blocks because they provide the best chances for new entrants to compete nationally with the major wireless carriers. Fracturing the C1 block licenses into separate EAs (with no assurance presently that package bidding will be allowed) and eliminating their open platform requirements, and ensuring the Commission's reconsideration of the public-private partnership for the D block license, could help the dominant incumbents deter entry of nationwide competitors. Thus it is possible that the major incumbents will bid on the C and D Blocks in the initial auction only if the entrants are able to bid enough to meet the reserve prices for these blocks, even though these incumbents' valuations of the blocks with the restrictions exceed the reserve prices.

Even if entrants meet the reserve prices for C and D, incumbents will want to force a re-auction for at least one block to delay license awards for the C and D Blocks and jeopardize the business plans and financing of the entrants. Thus, one can expect filings and litigation (about the currently ill-defined specifications of the alternative licenses, provisions for entry of new bidders, etc.) that could delay the re-auction for many months.

An implication of the previous paragraph is that the success of the initial auction may hinge on the activity rule to keep the major incumbents actively involved in the bidding. But the activity rule was initially designed for the much more straightforward PCS auctions, not an auction with a built-in provision for re-auctions with changed service rules. There is little assurance that the activity rule can get incumbents to reveal their true willingness-to-pay for the licenses offered in the first of two auctions, the second of which they prefer due to less stringent performance obligations. Indeed, once it is clear that without their bids the re-auction will ensue, the major incumbents may prefer to drop out of the bidding.

#### **1.4. The proposed reserve prices are arbitrarily high**

The threat that the initial auction will fail is amplified by the magnitude of the proposed reserve prices, which are based on market prices in the AWS auction. This reserve policy is contrary to the theory of optimal reserve prices, which finds that in auctions of items with substantial value components that are common across bidders it is best to use low reserve prices; i.e., ones no higher than the seller's (in this case the public's) opportunity cost of alternative uses or deferring sale – which in this case means the revenue from a much delayed 3<sup>rd</sup> auction, net of the loss to consumers of delayed service and delayed competition that would lower retail prices. This policy is also contrary to the established and successful FCC practice of using much lower reserve prices in previous auctions.

The Commission's Second Report and Order sets out block-by-block aggregate reserve prices for the five blocks to be auctioned.<sup>3</sup> Our understanding is that the aggregate

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<sup>3</sup> 700 MHz Notice, ¶¶7, 51.

reserve price for each block is intended to ensure that the Treasury “recover[s] an appropriate portion of the value of the public spectrum resource....”<sup>4</sup> It appears that the Commission is trying to define “an appropriate portion” as the market price using the results from the AWS auction completed last year. There is no established theory or practice that suggests that using an estimate of the sale price as the reserve price is the best way to obtain the value of the resource from competitive bidding in an auction. A take-it-or-leave offer might be optimal in a bargaining situation, but the purpose of an auction is to elicit from bidders their willingness to pay for licenses because the seller does not know and cannot know their actual valuations. The proposed policy amounts to a “take it or re-bid in the re-auction” with weaker performance requirements, which hardly amounts to a credible strategy by the seller. Further, it is inexplicable that the Bureau offers no explicit calculation of the costs to the licensees of the geographical buildout requirements, which require many more installations and thus are much more expensive.

As the Commission acknowledges and the law requires, the FCC’s goal should be social welfare maximization, not revenue maximization in the auction. Essentially a reserve price should ensure that the spectrum is sold, but not sold for an unreasonably low price. Traditionally, the FCC has used modest reserve prices or small minimum opening bids to satisfy this goal. The AWS auction had a reserve price, but that reserve was tied directly to an opportunity cost – the cost of relocating incumbent users. In this case, the reserve price is not tied to an opportunity cost such as, for example, the cost of funding the DTV transition. As a result, the reserve prices in this auction are not set to measure the opportunity cost and may, as we argued above, create perverse incentives for bidders to hold back in their bidding.

#### **1.4.1. High reserve prices are contrary to established auction theory**

In a single-unit common-value auction, a reserve price might be beneficial (to increase revenues) if there is a large gap between the known valuation of an asset by the bidder with the highest valuation and the bidder with the second highest known valuation. In this way, a reserve price might increase the amount that the seller receives. However, to make the reserve price have an effect, the seller must set the reserve price higher than the price known to be willing to be paid by the second-highest bidder.

If the reserve price is higher than the price willing to be paid by the second-highest bidder, then the auction will have only a single bidder. Any other bidder would not participate because it would know that it could not win the auction with a profit. So, the highest-value player wins the auction at the reserve price.

However, if the highest-value bidder knows that there will be a subsequent re-auction with a lower reserve price or weaker service conditions that enhance the value of the license, then that will induce the bidder not to raise her own bid to satisfy the reserve price but instead to wait for the re-auction.

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<sup>4</sup> 700 MHz Notice, ¶ 51.

With multiple licenses forming a block, a bidder for a portion of the block (e.g. a bidder interested in a single EA) might bid, but each high bidder would still have the same incentive to win at the re-auction for a lower price or lessened restrictions. In addition, each bidder has an incentive to hold back on raising her own price to make the block price satisfy the reserve in the hopes that other bidders will raise their bids. The incentive to hold back is mitigated somewhat by the bidding and activity rules, but by no means completely. For example, once it is clear that the reserve price will not be met without “volunteers” raising their bids, all high bidders can stop bidding and others can relinquish their eligibility since all that matters now is the re-auction.

As we argued before, an especially perverse consequence of the re-auction of a block is that losing bidders in the initial auction have little incentive to bid in the re-auction, since they know already that they were outbid initially. But without the second-highest bidder present in the re-auction, the one who bid highest in the initial auction might now obtain the license for a lower price and with less stringent performance requirements, if the reserve price is met in the 2<sup>nd</sup> auction – or even better, wait for the 3<sup>rd</sup> auction of the block and obtain the license for an even lower price than offered in the initial auction. Indeed, failure to meet the aggregate reserve price in the first auction will be a strong predictor that the same reserve price will not be met in the re-auction since much the same forces are at work.

We have warned in our previous filings: both auction theory and practice tell us that if it is clear before the (re-)auction who the winners will be, then the auction attracts no (or virtually no) competition and ends in embarrassingly low revenues. The Commission has wisely introduced the anonymity restrictions to increase the chances of new entrants to succeed in the initial auction and as a result enhancing competition in the initial auction. But should the re-auction be needed, these efforts will be wasted and the prospect of that invites bidders to withhold their bids.

In summary, having such high reserve prices may frustrate the Commission’s objectives to have the spectrum used efficiently and quickly. In fact, auction literature about common value auctions shows that the optimal reserve price should be no more than the opportunity cost of re-offering the license later.<sup>5</sup>

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<sup>5</sup> See Dan Levin and James L. Smith, “Optimal Reservation Prices in Auctions,” *The Economic Journal*, Vol. 106, No. 438 (Sep., 1996), pp. 1271-1283. The abstract: “The authors relax the IPV [independent private values] assumption; characterize optimal reservation prices in a richer class of auctions; and show that, when information is correlated, the seller’s optimal reservation price converges to his true value, often monotonically and rapidly, as the number of bidders grows.” This conclusion is strengthened further when the seller’s objective is social efficiency. Other articles obtain different conclusions because they rely on the assumption of independent private values – which is far from true in the spectrum auctions – and assume that the objective is revenue maximization. Several of these are the following:

Avery, Christopher and Terrance Hendershott (1998), “Bundling and Optimal Auctions of Multiple Goods,” Working Paper, Harvard University.

Bulow, Jeremy and John Roberts (1989), “The Simple Economics of Optimal Auctions,” *Journal of Political Economy*, 97, 1060-1090.

Maskin, Eric and John Riley (1984), “Optimal Auctions with Risk Averse Buyers,” *Econometrica*, 52, 1473-1518.

### **1.4.2. The use of AWS auction revenues to calculate reserve prices is arbitrary and without precedent**

Even if one thinks, contrary to theory and practice, that the reserve price should be set equal to expected revenue, the comparison to the AWS auction for determining expected revenue and hence reserve prices is arbitrary and unprecedented. While we are not offering an opinion on the valuation of the 700 MHz spectrum and we stress that the optimal reserve prices should be set at a small fraction of the expected revenues, there are at least three reasons why the revenues in Auction 73 may differ from the AWS auction revenues. First, as discussed above, changed macroeconomic factors and credit market conditions will have an effect on the bidding in the auction.<sup>6</sup> Second, there are important new conditions imposed on all licenses that are being auctioned that will require licensees to incur much greater buildout costs. Third, the 700 MHz spectrum has different propagation characteristics that make the licenses more suitable for low population density areas.

The way that the Notice bases the reserve prices on the AWS prices provides little basis for a reasonable comparison with the AWS band. The Notice simply assumes that various different factors will offset, or be worth specific amounts. For example, the buildout requirements on the Lower A, B and E Blocks are substantially more stringent than the AWS buildout requirements, and hence will require much greater expenditure. Because these factors lead to higher upfront construction costs, the willingness to pay for the license, also an upfront cost, should be lower by a similar amount.

In addition, the Notice has no discount at all for the unpaired spectrum in the Lower E block. While there are technologies such as TDD that can operate in unpaired spectrum, the E block has less spectrum and does not have the potential to be paired, thus the options for its use are lower and it should sell at a discount to paired spectrum.

Furthermore, the high power, high tower “option” in the Lower 700 MHz – and its concomitant interference concerns – is unique to this auction and represents a significant departure from the more traditional AWS power output requirements. It is difficult to know in advance how these unique rules will affect bidder valuation relative to AWS prices. The imposition of reserve prices arbitrarily keyed to prior auctions, with different service rules, will only impede the revenue- and social welfare-maximizing price discovery process.

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Myerson, Roger B. (1981), “Optimal Auction Design,” *Mathematics of Operations Research*, 6, 58-73.  
Riley, John G. and William F. Samuelson (1981), “Optimal Auctions,” *American Economic Review*, 71, 381-392.

<sup>6</sup> To the extent that recent events have increased borrowing costs for potential bidders, that would lead in turn to a lower willingness to pay for spectrum and a lower market clearing prices. Simply using the AWS prices from a time period with lower capital costs would lead to an overestimate of the current market value of the spectrum. For example, just this week, there has been a flurry of news stories about the effect of changed capital markets on private equity deals such as Home Depot.

Google asserted that it would be willing to bid \$4.6 billion for the C Block if the Commission adopted its four openness principles.<sup>7</sup> However, the Commission did not adopt those principles and if Google decides not to bid, our earlier paper shows that the incumbents might be able to get this block at a very low price.<sup>8</sup> The incumbents may benefit even more from the reserve price's effects of delaying entry and impairing competition so they do not have an incentive to bid aggressively on the C Block.

Finally, with respect to the D Block, the Notice arbitrarily states, "However, in light of the D Block license conditions essential to the public safety purpose of the public/private partnership, it might be appropriate to expect bidders to bid only about 75 percent to 80 percent of such an amount, or about \$1.33 billion."<sup>9</sup> We can find no rationale whatsoever, for the 75 percent to 80 percent. It would be much better for the Bureau to estimate the extra costs of the buildout required to meet the extra requirements of the D Block license.

For the D Block, the buildout, service and reliability requirements are much greater than for the AWS licenses. The need to negotiate with Public Safety after the auction adds uncertainty and potential costs. Appendix B to this report provides a summary of the requirements that the D Block licensee must satisfy, in addition to negotiating an agreement with the Public Safety Broadband Licensee. Rather than taking what appears to be an arbitrary (and low) estimate of these costs, at a minimum, the Commission should try to estimate the costs and come up with a justifiable adjustment to the AWS valuation.<sup>10</sup> For example, the Technical Appendix at Attachment C to the Frontline Comments suggests that the increased coverage requirements for the D Block will lead to an 82% increase in the number of cell sites compared to a 75% coverage requirement in the C Block (itself considerably more onerous than the AWS "substantial service" requirement). An 82% increase in site count, combined with increased per-site expenses due to hardening and redundancy of the network for public safety, and added negotiation risks to boot, is likely to lead to more than the FCC's assumed 20 to 25% discount.

In each of the blocks the FCC imposed conditions different than those on the AWS licenses: buildout, openness, and working with public safety. It is possible that the Commission is attempting to use reserve prices to serve as a proxy for the amount that it is willing to sacrifice in terms of auction revenue to get these terms. For example, the FCC might determine that the increased buildout on the A Block is worth \$50 million in terms of social value. Using the reserve prices (with indeterminate re-auction rules as discussed below) is a bad and indirect way to try to accomplish that goal. In fact, it is unlikely to create a true comparison of value. If putting a maximum price tag on the more onerous conditions were the Commission's goal in setting artificially high reserve prices, it would be better to allow bidders to submit bids for the licenses with different sets of

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<sup>7</sup> Letter from Eric Schmidt to Kevin Martin, July, 20, 2007.

<sup>8</sup> We do note that Eric Schmidt said that Google "probably" would bid in the auction at a Progress and Freedom Foundation conference. However, it is not clear that Google will bid, nor is it clear that it will bid \$4.6 billion for the C Block in that auction.

<sup>9</sup> 700 MHz Notice¶ 52.

<sup>10</sup> We have taken a different approach to reserve price below (the one the FCC used last year with the AWS auction) so we do not do this calculation.

restrictions and then compare the totals from the two sets of bids and determine the winner based on the predetermined differential. There is a well developed theory and practice of such “menu auctions” in which bidders can express their willingness to pay for licenses with differing performance requirements.

In our opinion such an auction design would be better than the current one. It would allow the market to decide whether the relative credit offered by the FCC for agreeing to the additional conditions is worth paying the additional development costs. Also, it would dissolve the temptation (discussed above) of the players to restrict their bids to cause the re-auction. Unfortunately, it is our understanding that this is beyond the scope of the Wireless Bureau’s mandate to make such changes to the auction design, since it is directed by the Commission to use the re-auction with different service requirements and aggregate reserve prices. In Appendix C to this report, we sketch out another way for the FCC to embed its value for the restrictions it is placing on the licenses, but again, we think this proposal may be beyond the scope of the Public Notice so we leave it in an appendix. Therefore we focus our recommendations on the only other remaining part of the design that can solve this problem: the level of the reserve prices.

### **1.5. Recommendation: Reasonable reserve prices**

We recommend that the Wireless Bureau set the reserve price, even if it is for an entire block as directed by the Commission, to take account of the ultimate affects of diminished competition in the 1<sup>st</sup> auction from a high reserve price, and the subsequent weakening of competition in the 2<sup>nd</sup> auction if the reserve price is not met in the 1<sup>st</sup> auction, as well as the dire effects of failing to meet the reserve price in the 2<sup>nd</sup> auction and thus necessitating a 3<sup>rd</sup> auction. We also recommend that the Bureau take account of the established theory about optimal reserve prices.

Our understanding is that the aggregate reserve price for each block is meant to ensure that the Treasury “recover[s] an appropriate portion of the value of the public spectrum resource....”<sup>11</sup> The Commission had the same instructions for its auction of the AWS spectrum, but in addition, it had a constraint that it had to pay for the relocation of incumbent government users.

In the AWS auction, the Commission set a reserve price of \$2.06 billion (the actual reserve price was half of this amount, but only half of the bids counted toward the reserve price). The Commission set the reserve price at \$2.06 billion because it had been determined that relocating the incumbent government users from the half of the spectrum they occupied would cost \$1.03 billion. Had the auction raised less than \$1.03 billion, it would have been a bad idea to relocate the government users because the spectrum was worth less to the new users than the cost of relocating the existing users.

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<sup>11</sup> 700 MHz Notice, ¶ 51.

Under the opportunity cost principle, the reserve price should be thought of as a maximum of two measures: the cost to relocate incumbent users and the value of waiting and selling the spectrum at some later point in time.

In the AWS auction, the Commission used the relocation cost as its measure of opportunity costs, presumably implicitly assuming that the value of waiting to sell the spectrum was lower (in fact, delay probably has a negative social value). Ultimately, the AWS auction realized revenues substantially greater than the reserve price.

There are at least three possible ways to use the AWS reserves to guide the choice of reserves in the 700 MHz auction. First would be to use the same overall value of \$2.06 billion since the Commission was apparently equating the two blocks for value as well. Second would be to take the AWS reserve as a percentage of the AWS sales price, \$13.7 billion (15%) and apply it to the expected sales price of the 700 MHz auction (CBO has a high estimate of \$14 billion) to get a reserve price.<sup>12</sup> Third would be to use the opportunity cost of relocating the broadcasters based on the amount allocated for the final subsidy of set top boxes (\$1.5 billion if supplemental funds are allocated).<sup>13</sup>

The implied reserve prices from following these methods are listed below (using the ratios from the FCC’s initial proposed reserve prices that do not adjust for the unpaired nature of the E Block):

	<u>AWS Reserve</u>	<u>15% of estimated revenues</u>	<u>Set Top Box</u>
Block A	\$370M	\$378M	\$270M
Block B	\$282M	\$287M	\$205M
Block C	\$950M	\$969M	\$692M
Block D	\$273M	\$278M	\$198M
Block E	\$185M	\$189M	\$135M
Total	\$2.06 billion	\$2.10 billion	\$1.5 billion

Overall, it would be much better for the FCC to set more modest reserve prices as described in the table above. That will lead to vigorous bidding and market prices and would be consistent with the rules used by the FCC in the past.

In summary, setting the reserve prices so unprecedentedly high creates a real risk that the Auction 73 will end up as a major fiasco and embarrassment for the FCC. The reserve prices are much too high, create a threshold problem making the bidders withhold bids and look for “parking” strategies to withhold bidding until the reserve is met, and reward such delay strategies by a promise of less restrictive licenses in the re-auction. We are

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<sup>12</sup> We argued above that these estimates should be revised to account for the changes in the cost of capital and macroeconomic conditions. The benefit of using reserve prices on the order of 10-20% of expected revenues is that even if the economic conditions change, it is highly likely that such reserve prices will not turn out to be prohibitively high.

<sup>13</sup> Total relocation costs would include the cost already borne by granting the broadcasters the rights to use a second channel, but those costs are sunk and not impacted by the auctioning of the spectrum now.

afraid that each of these factors is potentially dangerous on its own and that the combination of the three of them can end in disaster.

Based on that discussion and given the limited Bureau's mandate, we recommend:

***Recommendations:***

- 1. In line with the past practice, set the reserve prices, at most, at \$378M for Block A, \$287M for Block B, \$969M for Block C, \$278M for Block D and \$189M for Block E. These more reasonable reserve prices should apply to both the initial and the contingent re-auction.**
- 2. To avoid delays in the deployment of the Public Safety Network, base the reduction of the D Block reserve on a realistic estimate of costs of the stringent public safety requirements rather than the arbitrary 22% discount.**
- 3. In estimating the value of the E Block take into account the restricted usability of the unpaired spectrum.**

## **2. Provisions for re-auction**

In this section we further comment on the provisions in section “**V. CONTINGENT SUBSEQUENT AUCTION**” (DA 07-3415, paragraphs 94-103) of the Bureau's request for comments. Since we already discussed in the previous section some of the negative consequences of the re-auction provisions for revenue and timely and efficient allocation of the licenses, here we focus only on the major uncertainties that remain about the organization of the contingent re-auction. If unresolved before the auction, this uncertainty will have a further negative impact on bidding.

### ***2.1. Need for clear rules for the re-auction***

#### **2.1.1. Eligibility**

We are concerned that although the Commission directed “the Wireless Bureau to propose and adopt procedures that give applicants an opportunity to obtain bidding eligibility specifically for the alternative licenses, in addition to the initial licenses” there seem to be no specifics in the Bureau's proposed rules for new bidders to enter the re-auction in a way that is consistent with the primary directive that the Wireless Bureau “establish procedures that limit qualified bidders in a subsequent auction of alternative licenses to those bidders that qualify to bid in the upcoming auction offering 700 MHz Band licenses in all of these blocks.” We ask that the Bureau clarify substantially the rules for determining exactly who are the qualified bidders in the re-auction. For example, is qualification determined by the initial short-form application, by initial upfront payments, or before the re-auction by some repetition of these procedures with allowance for altered eligibility now that the performance requirements or band definitions are altered? Must a bidder solely for the alternative licenses offered in the re-auction file a short-form and make upfront payments before the initial auction?

### **2.1.2. Changes in license specifications**

We are concerned that the re-auction will delay grant of licenses for all blocks, even those whose reserve prices were met in the initial auction. The Bureau supposes that a re-auction can begin within two months of the close of the initial auction, but we see risks that complaints or legal actions could delay the beginning of the re-auction for many months, especially since the Commission leaves until later what some of the altered specifications will be. To avoid further costly delays, we argue that the Commission should specify before the initial auction the changes to license specifications it will make in the re-auction.

### **2.1.3. Auction rules for the re-auction**

The Bureau also leaves in doubt whether in a re-auction there will be package bidding for C1 and C2 (and for a package of C1 and C2). We specifically urge the Bureau to allow package bidding in the re-auction for three levels of block C so that it would be possible to bid for a package of C1 and C2, as well as for packages of C1 and C2 separately. Remarkably, the D Block license would be re-auctioned under exactly the same conditions as failed to meet the reserve price in the initial auction just a few months before, except for the vague “possibility of re-evaluating all or some of the applicable license conditions” (which is an open invitation for filings requiring further delays).

We believe that these aspects will cast a cloud of uncertainty over the initial auction until the aggregate reserve prices are exceeded for every block, and indeed this uncertainty about the final outcome of the 700 MHz auctions could persist well past the close of the initial auction. Business plans and bidding strategies will necessarily be affected by uncertainties about the specifications of the licenses that will ultimately be granted by the FCC. For example, a bidder might win local licenses in the A, B, or E Blocks in the initial auction, yet not know whether a re-auction will enable bidding on additional local/regional licenses in the C1 and C2 Blocks. We urge the Bureau and the Commission to remove as much uncertainty as possible by clarifying beforehand the specifications of the licenses and their performance requirements that would be offered in the re-auction.

## **3. Ensure flexibility to bid on substitutable licenses**

In this section we comment on a problem with the activity rule caused by the disparity between the size of the license for the D Block and the size of a package bid for the C Block’s REAGs 1-8. To obtain maximum efficiency of the auction outcome, the activity rule should allow a bidder to alternate bids for licenses that are substitutes, without sacrificing eligibility. In the re-auction it will be possible for a bidder to alternate among license D and packages of C1 and C2, which in many ways are substitutes (albeit with differing service requirements). But this will not be possible in the initial auction, as proposed by the Bureau, because a package bid for the C Block includes more than twice the MHz as the license for the D Block.

In the following, we explain how this deficiency can be remedied in the initial auction without splitting the C Block as it will be should there be a re-auction:

Count the PBSL's MHz in determining the MHz-pops for the license on the D Block for the initial auction. This would make the D license comparable in MHz-pops to the C package, reflecting the D Block licensee's ability to make use of the PSBL spectrum.

### **3.1. Background**

The Simultaneous Multiple Round (SMR) auction design is used worldwide to allocate goods. An important property of the SMR procedure is that it promotes efficient allocation of the items. In particular, an SMR auction allows discovery of efficient relative prices of the auctioned items. It does this by allowing bidders to choose at each stage what to bid on depending what are the relative prices at that time. At the end of the auction, this achieves efficient allocation of the goods at the final prices. In contrast, in a sequential auction bidders must decide on their bids for the first item before they know the prices of the subsequent items, which makes it difficult to design good bidding strategies and makes it likely that the final allocation will be inefficient.

The SMR auction has an ideal equilibrium in which each player bids sincerely by increasing his bids on the goods that he values most, net of current prices. This leads to efficient allocation of the goods via dynamic simultaneous price discovery. In an SMR with no activity rules, however, a player can have incentives to use other strategies, for example a "wait and see" strategy in which the player does not bid until the relative prices are set by others and only then decides which licenses to acquire. Unfortunately, if several bidders employ such a strategy, the auction proceeds slowly and price discovery is impaired.

To exclude the "wait and see" strategy, an SMR auction imposes an activity rule that forces interested bidders to be active throughout the auction – and in particular to be active early if the bidder wants to remain eligible to bid later in the auction. Activity rules must strike a balance between promoting activity and efficiency. Efficiency could be compromised if at an early stage a bidder drops out of bidding on item A, and then at some later stage he wants to bid on A again, but cannot because he is no longer eligible to bid on A due to the activity rule.

For example, suppose that two goods A and B are auctioned and a bidder values A by \$100 more than B. Suppose that he starts bidding for A, but at some point the current highest bid on A is more than \$100 more than the highest bid on B. This bidder wants then to switch to bidding on B because its net value is now greater than the value of A net of the current price. Further, if the difference between the two highest bids on A and B later drops below \$100, the bidder wants to resume bidding on A. If he can do so, as the original design of SMR assumes, then at the end of the auction he will acquire the good that is more valuable to him given the final prices. However, if the auction rules are such that, after moving from bidding on A to B, he cannot later resume bidding on A, then at the end of the auction he may regret that he cannot now out-bid the highest bid on A. The end result is an inefficient allocation and often reduced revenue for the seller. The problem is compounded further when all the players alter their bidding strategies to avoid losing eligibility that they might later regret.

If the auction offers relatively similar objects (unlike Auction 73) then the activity rules proposed by the Wireless Bureau for the upcoming auction performs well; e.g., if the FCC is selling 100 licenses that each count equally for eligibility then the activity rule prevents bidders only from having low demand at low prices and high demand at high prices, which is not a binding constraint when the goods are substitutes.<sup>14</sup>

However, when auctioning different licenses that count much differently toward activity (as in Auction 73), the standard activity rule performs poorly. Specifically, even if a bidder is interested in acquiring any package of the licenses if the prices are right, the activity rule prevents movement of bidding activity in both directions between smaller and larger licenses (for example, with the same geographical coverage but with different bandwidth).

Disparities among the licenses' sizes have a further consequence that results from the bidders' strategies of sustaining eligibility by bidding on larger licenses. Typically the prices for the larger licenses are settled first and the prices for the smaller ones later. This occurred in the recent AWS auction where the REAG licenses sold for much more than licenses carved into smaller geographic areas that should have sold for the same price in the aggregate had there been no auction design problems. The induced sequential auction can cause ex-post regret, an inefficient allocation, and reduced revenue. Thus much of the benefit of the SMR auction design is lost, all because of an activity rule that looks innocent but in fact is poorly adapted to handling disparities in the sizes of licenses.

### **3.2. Recommendations**

These problems are especially important in the 700 MHz auction because the band plan and the additional restrictions on the C and D Blocks as well as the stringent build-out and service requirements on the A, B, and E Blocks make the auctioned licenses very different in terms of value and they also count very differently for activity.

There are two ways to reduce these problems. The first is to create licenses that are as close substitutes as possible. The second is to adjust the activity rule to take into account the differences across licenses to allow for bi-directional movements of bidding activity.

In the context of this Public Notice without changing the band plan, we suggest adjusting the activity rule in the first phase of the auction to enable easier bidding for different blocks. In particular, if the C Block is not split, then to promote efficiency adjust the

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<sup>14</sup> It can have drawbacks for bidders that consider licenses to be complements and are afraid to bid early because of the exposure risk. This is a known problem, but relaxing the activity rules to resolve that would mean allowing more of the "wait and see" strategies. In the case of exposure risk, the "wait and see" strategy is not necessarily bad for the efficiency of the auction outcome, but the problem is that if we allow this strategy for players to fight the exposure risk, we automatically allow it for other bidders with less benign motives. Two ways to strike a balance are to have a less strict activity rule early in the auction (and a stricter one later), and/or to allow package bids. Although the proposed auction rules employ both, they are not sufficient in the way they are implemented because they do not take into account the differences in licenses that we discuss.

MHz-pops on the D Block to include the MHz from the PBSL license, thus making it count as 22 MHz, the same as the C package of the REAGs 1-8. Then a bidder would be able to substitute between the D Block and the package for the C Block REAGs 1-8 depending on their relative prices.

A relevant consideration is that allowing for the bi-directional movement of activity makes it easier for a bidder to “park” their eligibility, which can hinder price discovery, though usually to a minor extent. We think that parking will not be a large issue in the 700 MHz auction, especially if our recommendations below regarding opening bids and bid increments are adopted.

***Recommendation:***

**Ensure efficient substitution between the C and D Blocks by counting the PBSL MHz in determining the MHz-pops for the D Block license.**

#### **4. Meaningful anonymity is important to new entrants**

In this section of our comments we urge the Bureau to clarify further the provisions for anonymous bidding as well as their relation to the anti-collusion rules.

In Section IV.A.1 of the Notice, the Wireless Bureau asks for comment on the details regarding the proposal for implementing anonymous bidding. We agree with the Bureau that to achieve the goal of reducing predatory and collusive strategies it is important to sustain anonymity not only during the auction but prior to the auction regarding eligibility. Such anonymity promotes entry into the auction since new entrants do need to be afraid of being treated differently from other bidders in the auction.

Therefore, we think that most of the proposed anonymity rules, in particular the far reach of the anonymity rules within every auction, serve very well the intended purpose. However, to prevent any predatory strategies or signaling, we suggest that the FCC should clarify that it intends the anonymity rule to apply not only to the FCC but also to the bidders. That is, bidders should not be allowed to discuss or make public announcements regarding their bids or bidding strategy. In essence, the FCC should be clear that the combination of the anonymity provisions and the collusion rules mean that bidders cannot communicate privately or publicly about bids, bidding strategy or eligibility.

Of course, some communication with potential bidding partners or investors must be allowed. Therefore, we suggest that in addition to the proposed rules the FCC specifies the following:

- a) Starting on the date of the short form, no bidder can publicly announce the amount of the bidder’s upfront payment and bidding eligibility. Also, a bidder cannot also publicly announce its bidding strategy, in particular, which licenses it has or is going to bid on or the bidding amounts. Bidders can discuss this

information subject to confidentiality clauses with potential or current partners and investors (subject to the Commission's collusion rules).

b) During the auction the bidders are not allowed to publicly announce any information about their past or future bidding in Auction 73.

c) The FCC should emphasize that its rules do not supersede the antitrust laws and that any personnel, consultants and attorneys should take caution not to reveal (intentionally or inadvertently) any information that can impact the auction. In general, the antitrust laws focus on firms with market power and any firm with market power should be extremely cautious about any communication that might impair the auction or participation in the auction by new entrants.

Even the slightest indication of interest toward or against a specific license prior to the auction can spoil the benefits of anonymity and have major anti-competitive effects. Bidders should be made aware that such behavior will be deemed anti-competitive and therefore may have serious legal consequences.

It is our understanding that these points are not additions to the anonymity rules proposed by the Bureau, but rather clarifications of the intended policy needed to remove any remaining uncertainty regarding the rules.

#### ***4.1. Anonymity should be voluntary between the first auction and the re-auction***

Maintaining anonymity after the end of the first auction through the end of the subsequent contingent auction creates more serious tradeoffs. First of all, should the contingent auction be needed, we think that it is plausible (and perhaps likely) that there could be a considerable delay between the first and the second auction.

Maintaining secrecy for three months or more past the close of the auction (especially if the money is due right after the close of the first auction) will be difficult and will be especially harmful to new entrants and smaller businesses that may need to access outside money for their business plans. Such problems could lead to strategic actions by incumbents to delay intentionally the start and subsequent close of the re-auction.

On the other hand the benefits of keeping secret the identities of the winners in the first auction are limited. Once the final prices are set, the bidders are safe from predatory strategies. Also, as long as the eligibility, upfront payments and the identities of all non-winning past bids are kept secret, that would still ensure secrecy about the bidding plans for the second auction: bidders would not learn the individual strategies of their competitors nor they would know their eligibilities (planned or remaining).

Therefore, we propose a small change in the proposed anonymity rules: if the contingent re-auction is needed, winners of licenses in the first auction can ask the FCC to reveal publicly their identity. As a result, if a bidder is afraid that such release of information will be harmful, it can opt to keep the information private. However, if a bidder needs to have the information released to facilitate discussions with investors and to start

developing the network, it can opt to have the information revealed on a license by license basis.

Even though there is a risk that some bidders can use such information release to intimidate other bidders in the subsequent auction, such strategy cannot be focused on any firm in particular and hence cannot create much more harm than any other anonymous aggressive behavior.

***Recommendations:***

- 1. Clarify that anonymity rules interact with the collusion rules to prevent discussion of bids, eligibility and bidding strategy.**
- 2. Make the anonymity provisions voluntary between the first auction and the re-auction and begin the license grant process without waiting for the conclusion of the re-auction.**
- 3. Clarify that any release of information affecting the auction is subject to antitrust enforcement if it adversely affects the auction or post-auction competition for service.**

## **5. Additional auction rules**

### ***5.1. Package bidding***

The FCC has directed the Wireless Bureau to implement package bidding for the C Block unless it finds package bidding to be “impracticable.” The FCC’s package bidding proposal for the C Block should be easily implemented by bidders and by the FCC. Comments in this proceeding filed by Paul Milgrom and Karen Wrege and a subsequent report by Greg Rosston discussed how the FCC could implement a constrained package bidding system with a hierarchical package design.<sup>15</sup> The FCC’s proposal follows the hierarchical design and has only three packages so that bidders will understand the results and be able to derive bidding strategies.

The FCC should not abandon this package bidding design, because doing so would increase the exposure risk that new entrants would face in attempting to put together a competitive nationwide business. As Bulow, Levin, Milgrom and Salant said in their report filed with Alltel’s comments, the incumbent providers do not face an exposure risk but new entrants do.<sup>16</sup> Package bidding levels the playing field and removing it would seriously damage the prospects for new entry.

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<sup>15</sup> Comments and Reply Comments of Paul Milgrom and Karen Wrege in WT Docket 06-150. Rosston, Gregory, “Implementing Package Bidding in the 700 MHz Band to Improve Consumer Welfare,” submitted in WT Docket 06-150, February 5, 2007.

<sup>16</sup> Comments of Jeremy Bulow, Jonathan Levin, Paul Milgrom and David Salant in WT Docket 06-150, July 9, 2007.

## **5.2. Bid increments and minimum opening bids**

The FCC has proposed to move from its standard 9 bid increment “click box” bidding to allow only one or three bid increments. As discussed above, the purpose of a simultaneous multiple round auction is to allow price discovery, and one of the most important aspects is to be able to determine relative prices. Limiting the bid increments limits the ability of relative prices to adjust. While multiple increment (“jump”) bidding has been used sparingly, it can serve a useful purpose in adjusting relative prices.

For the D Block, we see no purpose served by having the minimum opening bid be lower than the reserve price. (As we have discussed above, the reserve price should be reduced). Regardless of the level of the reserve price, accepting bids below the reserve price conveys no information to the auction. It can also impair price discovery on other licenses by providing a place for a bidder to “park” its eligibility risk-free.

A valuable addition to the bid increments would allow a bidder at any time to place a bid for the C Block package of REAGs 1-8 equal to the reserve price for the entire C Block. This would ensure that subsequent bidding on the C Block would be sincere since other bidders would know that the C Block had reached the reserve price. Like the D Block, a package bid on the C Block below the reserve price conveys no information and serves as a risk-free parking spot. If the C Block package covered all 12 REAGs, then the minimum opening bid for the package should equal the reserve price, just like the D Block. But, since the REAG 1-8 package is not the complete block, allowing a bidder to input a bid equal to the reserve price can help speed the auction and promote more sincere bidding on all licenses.

## **5.3. Dropped bids**

The FCC should clarify what happens to a bid that is placed on one of the C Block REAGs when another bidder places a higher bid on the same REAG. If the second bidder later “drops” its bid, does the first bidder’s bid become part of the bids that are then used to compare against the package bid, or is it set at that level with the FCC as the “bidder?”

## **5.4. Payment clarifications**

Finally, the FCC should clarify two questions as to payment:

- When are payments due by winners of the auction if there is a contingent re-auction?
- When do upfront payments get returned if there is a contingent re-auction?

## APPENDIX A: C.V



Professor Peter Cramton  
Economics Department  
University of Maryland  
College Park MD  
20742-7211

240-396-1043

[pcramton@gmail.com](mailto:pcramton@gmail.com)  
[www.cramton.umd.edu](http://www.cramton.umd.edu)



[Peter Cramton](#) is Professor of Economics at the [University of Maryland](#) and Chairman of [Market Design Inc.](#) His research focuses on auctions, bargaining, and market exchange. Most of his recent work has addressed design and incentive questions in auctions and bargaining. He has served as an auction expert for numerous companies in spectrum auctions and electricity auctions. He has advised the FCC and several foreign governments on the design and implementation of spectrum auctions. Cramton has designed electricity markets in New England, Colombia, France, and Belgium. Before joining the Maryland faculty in 1993, he was an Associate Professor at Yale University and a National Fellow at the Hoover Institution at Stanford University. He has published numerous articles on auction theory, auction practice, and bargaining in major journals. Cramton received his B.S. in Engineering from Cornell University and his Ph.D. in Business from Stanford University.

### Academic Positions

*Professor of Economics*—Department of Economics, University of Maryland, August 1996 to present.

*Associate Professor of Economics*—Department of Economics, University of Maryland, August 1993 to June 1996.

*National Fellow*—Hoover Institution, Stanford University, September 1992 to August 1993.

*Associate Professor of Economics and Management*—Yale School of Management, Yale University, July 1988 to August 1993.

*Assistant Professor of Decision Theory*—Yale School of Management, Yale University, July 1984 to June 1988.

### Education

*Stanford University*, Doctor of Philosophy, June 1984, Graduate School of Business.  
Dissertation: *The Role of Time and Information in Bargaining*.

Cornell University, Bachelor of Science with distinction, May 1980, School of Operations Research and Industrial Engineering. Graduated first in class.

### **Courses Taught**

[Advanced Microeconomics](#). Doctoral course in the foundations of game theory.

[Game Theory](#). Undergraduate introduction to modern game theory.

[Market Design](#). An advanced undergraduate course on auction and market design.

*Microeconomic Analysis I*. Doctoral core course in microeconomic theory.

*Intermediate Microeconomics*.

*Negotiation and Competitive Decisions*. Developed for management program.

*Economic Analysis*. Taught in management program.

*Quantitative Analysis for Management Decisions*. Taught in management program.

*Theory of Choice II: Game Theory*. Doctoral course in game theory with emphasis on information and dynamics.

### **Research Interests**

Auction theory and practice, bargaining theory, dispute resolution, incentives, contract theory, game theory, decision theory, labor economics, industrial organization, experimental economics, information economics, and law and economics.

### **Honors**

Resident Scholar, Rockefeller Foundation, Villa Serbelloni, Bellagio, Italy, Spring 2007.

Departmental Undergraduate Teaching Award, Spring 1996 (2), Spring 1997 and Spring 2002.

Departmental Graduate Teaching Award, Fall 1994 and Fall 1998.

Hoover National Fellow, Hoover Institution, Stanford University, 1992-93.

Winner of the *1984 Leonard J. Savage Thesis Award* for an outstanding dissertation in Bayesian Economics.

American Assembly of Collegiate Schools of Business Doctoral Fellowship, 1983-84.

National Association of Purchasing Management Scholarship, 1983-84.

Dean's Award for Service to Stanford University, 1983-84.

Two-time recipient of *Stanford Merit Fellowship*, 1981-83.

Elected by the Operations Research faculty as outstanding senior, 1980.

### **Affiliations**

Econometric Society, American Economic Association, Society for Economic Analysis, and Society for the Promotion of Economic Theory.

## Research on Auctions

["Colombia's Forward Energy Market."](#) Working Paper, University of Maryland, August 2007.

["An Overview of Combinatorial Auctions"](#) (with Yoav Shoham and Richard Steinberg), *SIGecom Exchanges*, forthcoming, 2007.

["The Effect of Incumbent Bidding in Set-Aside Auctions: An Analysis of Prices in the Closed and Open Segments of FCC Auction 35"](#) (with Allan T. Ingraham and Hal J. Singer) *Telecommunications Policy*, forthcoming, 2007.

[Economist Letter to NTIA on 700 MHz Spectrum Auction](#) (with Andrzej Skrzypacz, Simon Wilkie, and Robert Wilson), 30 July 2007.

["Essential Entry: Revenues in the 700 MHz Spectrum Auction,"](#) Working Paper, University of Maryland, 13 July 2007.

["Revenues in the 700 MHz Spectrum Auction"](#) (with Andrzej Skrzypacz and Robert Wilson), Working Paper, University of Maryland, 27 June 2007.

["Economic Comments on the Design of the 700 MHz Spectrum Auction"](#) (with Andrzej Skrzypacz and Robert Wilson), submitted with [testimony of James L. Barksdale](#) to the U.S. Senate Committee on Commerce, Science, and Transportation, 14 June 2007.

"Auction Design for Colombia's Forward Energy Market," Working Paper, University of Maryland, July 2007.

["Product Design for Colombia's Regulated Market,"](#) Working Paper, University of Maryland, June 2007.

["Market-Based Alternatives for Managing Congestion at New York's LaGuardia Airport,"](#) (with Michael O. Ball, Lawrence M. Ausubel, Frank Berardino, George Donohue, Mark Hansen, and Karla Hoffman), in *Optimal Use of Scarce Airport Capacity, Proceedings of AirNeth Annual Conference*, The Hague, April 2007.

["Colombia Firm Energy Market,"](#) (with Steven Stoft), *Proceedings of the Hawaii International Conference on System Sciences*, January 2007.

["Simulation of the Colombian Firm Energy Market,"](#) (with Steven Stoft and Jeffrey West), Working Paper, University of Maryland, December 2006.

["New England's Forward Capacity Auction,"](#) University of Maryland, June 2006.

"Spectrum Auction Design," Working Paper, University of Maryland, April 2007.

- [“Why We Need to Stick with Uniform-Price Auctions in Electricity Markets,”](#) (with Steven Stoft), *Electricity Journal*, 20:1, 26-37, 2007.
- [“The Convergence of Market Designs for Adequate Generating Capacity,”](#) (with Steven Stoft), Working Paper, University of Maryland, April 2006.
- [Combinatorial Auctions](#), (with Yoav Shoham and Richard Steinberg) [MIT Press](#), 2006.
- [“Introduction to Combinatorial Auctions,”](#) (with Yoav Shoham and Richard Steinberg) in Peter Cramton, Yoav Shoham, and Richard Steinberg (eds.), [Combinatorial Auctions](#), 1-13, [MIT Press](#), 2006.
- [“The Clock-Proxy Auction: A Practical Combinatorial Auction Design,”](#) (with Lawrence M. Ausubel and Paul Milgrom) in Peter Cramton, Yoav Shoham, and Richard Steinberg (eds.), [Combinatorial Auctions](#), Chapter 5, 115-138, [MIT Press](#), 2006.
- [“Simultaneous Ascending Auctions,”](#) in Peter Cramton, Yoav Shoham, and Richard Steinberg (eds.), [Combinatorial Auctions](#), Chapter 4, 99-114, [MIT Press](#), 2006.
- [“Dynamic Auctions in Procurement,”](#) (with Lawrence M. Ausubel) in Nicola Dimitri, Gustavo Piga, and Giancarlo Spagnolo (eds.) *Handbook of Procurement*, Cambridge, England: Cambridge University Press, 2006.
- [“How Best to Auction Oil Rights,”](#) in Macartan Humphreys, Jeffrey D. Sachs, Joseph E. Stiglitz (eds.), *Escaping the Resource Curse*, Chapter 5, 114-151, New York: Columbia University Press, 2007.
- [“A Capacity Market that Makes Sense,”](#) (with Steven Stoft) *Electricity Journal*, 18, 43-54, August/September 2005.
- [“Review of the Proposed Reserve Markets in New England,”](#) (with Hung-po Chao and Robert Wilson) White Paper, Market Design Inc., January 2005.
- [“Auctioning Many Divisible Goods,”](#) (with Lawrence M. Ausubel) *Journal of the European Economic Association*, 2, 480-493, April-May 2004.
- [“Competitive Bidding Behavior in Uniform-Price Auction Markets,”](#) *Proceedings of the Hawaii International Conference on System Sciences*, January 2004.
- [“Vickrey Auctions with Reserve Pricing,”](#) (with Lawrence M. Ausubel) *Economic Theory*, 23, 493-505, April 2004. Reprinted in Charalambos Aliprantis, et al. (eds.), *Assets, Beliefs, and Equilibria in Economic Dynamics*, Berlin: Springer-Verlag, 355-368, 2003.
- [“Competitive Bidding Behavior in Uniform-Price Auction Markets,”](#) Report before the Federal Energy Regulatory Commission, March 2003.

- [“Rebuttal Addendum: Assessment of Submissions of the California Parties,”](#) Report before the Federal Energy Regulatory Commission, March 2003.
- [“Electricity Market Design: The Good, the Bad, and the Ugly,”](#) *Proceedings of the Hawaii International Conference on System Sciences*, January, 2003.
- [“Collusive Bidding in the FCC Spectrum Auctions,”](#) (with Jesse Schwartz) *Contributions to Economic Analysis & Policy*, 1:1, [www.bepress.com/bejeap/contributions/vol1/iss1/art11](http://www.bepress.com/bejeap/contributions/vol1/iss1/art11), 2002.
- [“Demand Reduction and Inefficiency in Multi-Unit Auctions,”](#) (with Lawrence M. Ausubel) Working Paper, University of Maryland, July 2002.
- [“Spectrum Auctions,”](#) in Martin Cave, Sumit Majumdar, and Ingo Vogelsang, eds., *Handbook of Telecommunications Economics*, Amsterdam: Elsevier Science B.V., Chapter 14, 605-639, 2002.
- [“Tradeable Carbon Permit Auctions: How and Why to Auction Not Grandfather,”](#) (with Suzi Kerr) *Energy Policy*, 30, 333-345, 2002.
- [“Pricing in the California Power Exchange Electricity Market: Should California Switch from Uniform Pricing to Pay-as-Bid Pricing?”](#) (with Alfred E. Kahn, Robert H. Porter, and Richard D. Tabors), Blue Ribbon Panel Report, California Power Exchange, January 2001.
- [“Uniform Pricing or Pay-as-Bid Pricing: A Dilemma for California and Beyond,”](#) (with Alfred E. Kahn, Robert H. Porter, and Richard D. Tabors), *Electricity Journal*, 70-79, July 2001.
- “How Affirmative Action at the FCC Auctions Decreased the Deficit,” (with Ian Ayres) in Ian Ayres, ed., *Pervasive Prejudice? Unconventional Evidence of Race and Gender Discrimination*, Chicago: University of Chicago Press, 315-395, 2001.
- [“Lessons Learned from the UK 3G Spectrum Auction.”](#) In U.K. National Audit Office Report, *The Auction of Radio Spectrum for the Third Generation of Mobile Telephones*, Appendix 3, October 2001.
- [“A Review of Markets for Clean Air: The U.S. Acid Rain Program,”](#) *Journal of Economic Literature*, 38, 627-633, September 2000.
- [“Eliminating the Flaws in New England's Reserve Markets,”](#) (with Jeffrey Lien) Working Paper, University of Maryland, March 2000.
- [“Review of the Reserves and Operable Capability Markets: New England's Experience in the First Four Months.”](#) White Paper, Market Design Inc., November 1999.

[“Collusive Bidding: Lessons from the FCC Spectrum Auctions,”](#) (with Jesse Schwartz)  
*Journal of Regulatory Economics*, 17, 229-252, May 2000.

[“The Optimality of Being Efficient,”](#) (with Lawrence M. Ausubel) Working Paper,  
University of Maryland, March 2001.

[“The Role of the ISO in U.S. Electricity Markets: A Review of Restructuring in California and PJM,”](#) (with Lisa Cameron) *Electricity Journal*, 71-81, April 1999.

[“A Review of ISO New England's Proposed Market Rules,”](#) (with Robert Wilson) White  
Paper, Market Design Inc., September 1998.

[Maryland Auction Conference,](#) May 29-31, 1998.

[“Auctioning Securities,”](#) (with Lawrence M. Ausubel) Working Paper, University of  
Maryland, March 1998.

[Simultaneous Ascending Auctions with Package Bidding,](#) (with John McMillan, Paul  
Milgrom, Bradley Miller, Bridger Mitchell, Daniel Vincent, and Robert Wilson)  
Report to the Federal Communications Commission, March 1998.

[“Efficient Relocation of Spectrum Incumbents,”](#) (with Evan Kwerel and John Williams)  
*Journal of Law and Economics*, 41, 647-675, October 1998.

[“The Distributional Effects of Carbon Regulation,”](#) (with Suzi Kerr) in Thomas Sterner  
(ed.) *The Market and the Environment*, Cheltenham, United Kingdom: Edward  
Elgar, chapter 12, 1999.

[“Ascending Auctions,”](#) *European Economic Review*, 42:3-5, 745-756, May 1998.

[“The Efficiency of the FCC Spectrum Auctions,”](#) *Journal of Law and Economics*, 41,  
727-736, October 1998.

[“Auctions and Takeovers,”](#) *New Palgrave Dictionary of Economics and the Law*, Peter  
Neuman (ed.), London: MacMillan Press, 1, 122-125, 1998.

[Package Bidding for Spectrum Licenses,](#) (with John McMillan, Paul Milgrom, Bradley  
Miller, Bridger Mitchell, Daniel Vincent, and Robert Wilson) Report to the Federal  
Communications Commission, October 1997.

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Paul Milgrom, Bradley Miller, Bridger Mitchell, Daniel Vincent, and Robert Wilson)  
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[“The FCC Spectrum Auctions: An Early Assessment,”](#) *Journal of Economics and Management Strategy*, 6:3, 431-495, 1997. Reprinted in Donald L. Alexander (ed.), *Telecommunications Policy*, Praeger Publishers, 1997.

[“Synergies in Wireless Telephony: Evidence from the Broadband PCS Auctions,”](#) (with Lawrence M. Ausubel, R. Preston McAfee, and John McMillan) *Journal of Economics and Management Strategy*, 6:3, 497-527, 1997.

[“Auction Design for Standard Offer Service,”](#) (with Andrew Parece and Robert Wilson) Working Paper, University of Maryland, July 1997.

[“Using Auctions to Divest Generation Assets,”](#) (with Lisa J. Cameron and Robert Wilson) *Electricity Journal*, 10:10, 22-31, December 1997.

[“Deficit Reduction Through Diversity: How Affirmative Action at the FCC Increased Auction Competition,”](#) (with Ian Ayres) *Stanford Law Review*, 48:4, 761-815, 1996.

[“Money Out of Thin Air: The Nationwide Narrowband PCS Auction,”](#) *Journal of Economics and Management Strategy*, 4, 267–343, 1995.

[“The Case for Affirmative Auction: From Conscience to Coffers,”](#) (with Ian Ayres) *New York Times*, 21 May 1995, F13.

[“Using Auction Theory to Inform Takeover Regulation,”](#) (with Alan Schwartz) *Journal of Law, Economics, and Organization*, 7, 27–53, 1991.

[“Dissolving a Partnership Efficiently,”](#) (with Robert Gibbons and Paul Klemperer) *Econometrica*, 55, 615–632, 1987. Reprinted in Paul Klemperer (ed.), *The Economic Theory of Auctions*, Volume 2, Cheltenham, UK: Edward Elgar, 2000.

## **Research on Bargaining**

[“ESOP Fables: The Impact of Employee Stock Ownership Plans on Labor Disputes,”](#) (with Hamid Mehran and Joseph Tracy) Working Paper, University of Maryland, September 2005.

[“Unions, Bargaining and Strikes,”](#) (with Joseph S. Tracy) in John T. Addison and Claus Schnabel, eds., *International Handbook of Trade Unions*, Cheltenham, UK: Edward Elgar, Chapter 4, 86-117, 2003.

[“Bargaining with Incomplete Information,”](#) (with Lawrence M. Ausubel and Raymond J. Deneckere), Robert J. Aumann and Sergiu Hart, eds., *Handbook of Game Theory*, Vol. 3, Amsterdam: Elsevier Science B.V., Chapter 50, 1897-1945, 2002.

- ["The Effect of Collective Bargaining Legislation on Strikes and Wages,"](#) (with Morley Gunderson and Joseph S. Tracy) *Review of Economics and Statistics*, 81:3, 475-487, 1999.
- ["Impacts of Strike Replacement Bans in Canada,"](#) (with Morley Gunderson and Joseph S. Tracy), *Labor Law Journal*, 50:3, 173-179, Fall 1999.
- ["The Use of Strike Replacements in Union Contract Negotiations: the U.S. Experience 1980–1989,"](#) (with Joseph S. Tracy) *Journal of Labor Economics*, 16:4, 667-701, 1998.
- ["Efficient Relocation of Spectrum Incumbents,"](#) (with Evan Kwerel and John Williams) *Journal of Law and Economics*, 41, 647-675, October 1998.
- ["Deception and Mutual Trust: A Reply to Strudler,"](#) (with J. Gregory Dees) *Journal of Business Ethics*, 5, 813–822, 1995. Reprinted in Carrie Menkel-Meadow and Michael Wheeler (eds.), *What's Fair*, John Wiley & Sons, 2004.
- ["Wage Bargaining with Time-Varying Threats,"](#) (with Joseph S. Tracy), *Journal of Labor Economics*, 12, 594–617, 1994.
- ["The Determinants of U.S. Labor Disputes,"](#) (with Joseph S. Tracy), *Journal of Labor Economics*, 12, 180–209, 1994.
- ["Promoting Honesty in Negotiation: An Exercise in Practical Ethics,"](#) (with J. Gregory Dees) *Business Ethics Quarterly*, 3, 359-394, 1993. Reprinted in Patricia Werhane and Tom Donalson, *Ethical Issues in Business: A Philosophical Approach*, Prentice-Hall, 1996, and Carrie Menkel-Meadow and Michael Wheeler (eds.), *What's Fair*, John Wiley & Sons, 2004.
- ["Strikes and Holdouts in Wage Bargaining: Theory and Data,"](#) (with Joseph S. Tracy) *American Economic Review*, 82, 100–121, 1992. Reprinted in Bengt Holmstrom, Paul Milgrom, and Alvin E. Roth (eds.), *Game Theory in the Tradition of Bob Wilson*, Berkeley Electronic Press, [www.bepress.com/wilson](http://www.bepress.com/wilson), May 2002.
- ["Strategic Delay in Bargaining with Two-Sided Uncertainty,"](#) *Review of Economic Studies*, 59, 205–225, 1992.
- ["Dynamic Bargaining with Transaction Costs,"](#) *Management Science*, 37, 1221–1233, 1991.
- ["Shrewd Bargaining on the Moral Frontier: Toward a Theory of Morality in Practice,"](#) (with J. Gregory Dees) *Business Ethics Quarterly*, 1, 135-167, 1991.
- ["Sequential Bargaining Mechanisms,"](#) in *Game-Theoretic Models of Bargaining*, Alvin Roth (ed.), Cambridge University Press, Chapter 8, 149–179, 1985.

[“Bargaining with Incomplete Information: An Infinite-Horizon Model with Two-Sided Uncertainty,”](#) *Review of Economic Studies*, 51, 579–593, 1984.

## **Other Research**

[“Ratifiable Mechanisms: Learning from Disagreement,”](#) (with [Thomas R. Palfrey](#))  
*Games and Economic Behavior*, 10, 255–283, 1995.

[“Relational Investing and Agency Theory,”](#) (with [Ian Ayres](#)) *Cardozo Law Review*, 15,  
1033–1066, 1994.

[“Cartel Enforcement with Uncertainty About Costs,”](#) (with Thomas R. Palfrey)  
*International Economic Review*, 31, 17–47, 1990. Reprinted in Stephen W. Salant  
and Margaret C. Levenstein (eds.), *Cartels*, Volume 1, Cheltenham, UK: Edward  
Elgar, 2005.

[“Nonrandom Mixing Models of HIV Transmission,”](#) (with Edward Kaplan, and A. David  
Paltiel) in *Mathematical and Statistical Approaches to AIDS Epidemiology*, edited by  
Carlos Castillo-Chávez, *Lecture Notes in Biomathematics Series*, Springer-Verlag,  
218–239, 1989.

## **Research Grants**

“Dynamic Matching Mechanisms,” National Science Foundation, August 2005 to July  
2008, \$264,188.

“Slot Auctions for U.S. Airports,” Federal Aviation Administration, Department of  
Transportation, September 2004 to August 2005, \$309,729.

“Rapid Response Electronic Markets for Time-Sensitive Goods,” National Science  
Foundation, July 2002 to June 2005, \$2,000,000.

“Multiple-Item Auctions,” National Science Foundation, July 2001 to June 2004,  
\$313,872.

“Auctions for Multiple Items,” National Science Foundation, April 1998 to March 2001,  
\$318,175.

“Auctions and Infrastructure Conference,” National Science Foundation, April 1998 to  
March 1999, \$25,000.

“Auctions and Infrastructure,” World Bank, March-June 1998, \$25,000.

“Applying Strategic Bargaining Models to Union Contract Negotiations,” National  
Science Foundation, April 1995 to March 1998, \$143,637.

“Applying Strategic Bargaining Models to Union Contract Negotiations,” National  
Science Foundation, April 1992 to March 1994, \$177,760.

“Strikes and Delays in Wage Bargaining: Theory and Data,” National Science  
Foundation, April 1990 to March 1992, \$153,407.

“Gaming Exercises in Negotiation and Dispute Resolution,” National Institute of Dispute Resolution, July to August 1988, \$6,000.

“The Role of Time and Information in Bargaining,” National Science Foundation, July 1986 to June 1988, \$40,000.

“Public Sector Cases on Negotiation,” Mellon Foundation, July to August 1985, \$12,000.

### **Editorial and Public Service**

*Journal of Industrial Economics*, Associate Editor, 1998-present.

Member, RTO Futures (a working group of economists, executives, and government leaders to address critical issues in electricity restructuring), 2000-present.

Panelist, National Science Foundation, Economics, 1999-2002.

Panelist, National Science Foundation, Electricity Power System Efficiency and Security, 2002.

Program Committee Chair, *North American Econometric Society Summer Meetings*, June 21-24, 2001.

Panelist, National Science Foundation, Knowledge and Distributed Intelligence, 1998.

### **Referee for**

American Economic Review, American Political Science Review, Cambridge University Press, *Econometrica*, *Economic Inquiry*, *Economic J*, *Economic Letters*, *Economic Theory*, *Energy J*, *Games & Economic Behavior*, *Group Decision & Negotiation*, *International Economic Review*, *International J of Game Theory*, *J of Business*, *J of Business & Economic Statistics*, *J of Conflict Resolution*, *J of Economic Theory*, *J of Economic Surveys*, *J of Economics & Management Strategy*, *J of Industrial Economics*, *J of Labor Economics*, *J of Law and Economics*, *J of Law, Economics & Organization*, *J of Political Economy*, *J of Public Economics*, *J of Regulatory Economics*, *Labour Economics*, *Management Science*, *Mathematical Social Sciences*, *Marketing Science*, MIT Press, National Institute for Dispute Resolution, National Science Foundation, Omega, *Operations Research*, OPSEARCH, *Quarterly J of Economics*, *Rand J of Economics*, *Research in Experimental Economics*, *Review of Economic Studies*, *Scandinavian J of Economics*, *Science*, *Social Choice & Welfare*, *Southern Economic J*.

### **Recent PhD Committees Chaired (Initial Placement)**

Martin Ranger, May 2005 (Indiana University)

Jeffrey Lien, August 2001 (US Department of Justice)

Allan Ingraham, May 2001 (Criterion Auctions)

Jesse Schwartz, August 1999 (Vanderbilt University)

Laurent Martin, July 1999 (University of Washington)

## **Entrepreneurship and Consulting**

Chairman, [Market Design Inc.](#) (with Lawrence Ausubel, R. Preston McAfee, Paul Milgrom, and Robert Wilson), a consulting firm that works with governments and companies in designing and implementing state-of-the-art auctions, 1995 to present (President since 1999, Chairman since 2003). Major projects:

- Design auction and suggest market reforms for British Columbia timber market.
- Design and implement auction to sell electricity capacity in France for Electricite de France and in Belgium for Electrabel.
- Design and implement auction to sell gas capacity in Germany and France.
- Design and implement U.K. auction to procure greenhouse gas emission reductions.
- Design and implement spectrum auctions in U.S., Canada and Mexico.
- Comment on design of spectrum auctions in Australia and U.S.
- Design and implement electricity auctions in California and New England
- Design auctions to divest electricity generation plants and power purchase agreements in U.S. and Canada.

Founder, [Criterion Auctions](#), a consulting firm that provides auction support services to governments and companies in high-stake auctions. December 2000 to June 2007.

Chairman and Founder, [Spectrum Exchange](#) (with Lawrence Ausubel, Paul Milgrom, and [Market Design Inc.](#)), a firm to create value for the public by promoting the efficient exchange of spectrum. 1999 to present.

## **Expert Reports, Affidavits, and Testimony**

DC Energy, LLC v. HQ Energy Services (US) Inc., Docket No. EL07-67-000, Federal Energy Regulatory Commission, "[Affidavit of Peter Cramton.](#)" August 2007. Affidavit arguing that HQ manipulated the NYISO TCC and day-ahead energy markets. On behalf of DC Energy, LLC.

The People of the State of Illinois, et al., Docket No. EL07-47-000, Federal Energy Regulatory Commission, "[Affidavit of Peter Cramton.](#)" June 2007. Affidavit arguing that the Illinois auction for energy for small customers was a competitive auction. On behalf of J. Aron & Company and Morgan Stanley Capital Group Inc.

Australia National Emissions Trading Taskforce, "Possible Design for a Greenhouse Gas Emissions Trading System," July 2007.

700 MHz Auction, Federal Communications Commission, "[Why Large Licenses are Best for the 700 MHz Spectrum Auction.](#)" April 2007. On behalf of Verizon Wireless.

New York Independent System Operator, Docket No. ER07-360-000, Federal Energy Regulatory Commission, "[Affidavit of Peter Cramton.](#)" February 2007. Affidavit identifying manipulation of New York's capacity market by KeySpan and the need for

market monitoring and mitigation. On behalf of Consolidated Edison Company of New York.

Devon Power LLC, et al., Docket No. ER03-563-030, Federal Energy Regulatory Commission, [“Affidavit of Peter Cramton,”](#) March 2006. Affidavit in support of the settlement agreement defining the New England Forward Capacity Market. For ISO New England.

AWS Auction, Federal Communications Commission, [“Declaration of Peter Cramton.”](#) February 2006. Declaration on various auction rules for the AWS auction. On behalf of T-Mobile US.

AWS Auction, Federal Communications Commission, [“Reply Declaration of Peter Cramton.”](#) February 2006. Reply declaration on various auction rules for the AWS auction. On behalf of T-Mobile US.

AWS Auction, Federal Communications Commission, [“Ex Parte of Peter Cramton.”](#) March 2006. Ex parte communication on various auction rules for the AWS auction. On behalf of T-Mobile US.

[MDI retained as Auction Manager](#) for virtual divestiture of 2,600 MW of nuclear energy as part of the proposed merger between Exelon and PSEG. August 2005.

US-Canada Softwood Lumber Trade Dispute, [“Competitive Auction Markets in British Columbia”](#) (with Susan Athey). December 2005. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Comments on DOC Notice of Preliminary Results of Countervailing Duty Review”](#) (with Susan Athey). July 2005. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Competitive Auction Markets in British Columbia”](#) (with Susan Athey). February 2004. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Upset Pricing in Auction Markets: An Overview”](#) (with Susan Athey and Allan Ingraham). March 2003. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“An Analysis of Auction Volume and Market Competition for the Coastal Forest Regions in British Columbia”](#) (with Susan Athey and Allan Ingraham). September 2002. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Reserve Prices, Stumpage Fees, and Efficiency”](#) (with Susan Athey and Allan Ingraham). September 2002. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Auction-Based Timber Pricing and Complementary Market Reforms in British Columbia”](#) (with Susan Athey and Allan Ingraham). March 2002. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Setting the Upset Price in British Columbia Timber Auctions”](#) (with Susan Athey and Allan Ingraham). September 2002. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Auctioning Timber to Maximize Revenues in British Columbia”](#) (with Susan Athey and Allan Ingraham). June 2002. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“A Comparison of Equation-Based and Parity Pricing of Stumpage Fees for British Columbia Timber Under Long-Term Tenures”](#) (with Susan Athey and Allan Ingraham). April 2002. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

US-Canada Softwood Lumber Trade Dispute, [“Testing for Anti-Competitive Bidding in Auction Markets”](#) (with Susan Athey and Allan Ingraham). March 2002. White Paper, Market Design Inc. On behalf of British Columbia Ministry of Forests.

New England Power Pool, Federal Energy Regulatory Commission, [“Review of the Proposed Reserve Markets in New England,”](#) (with Hung-po Chao and Robert Wilson) Market Design Inc., January 2005.

U.S. Department of Defense, [“Estimating Auction Revenues for the Proposed FCC Sale of 3G Spectrum for Broadband and Advanced Wireless Services,”](#) Criterion Auctions, December 2003.

Expert Report of Peter Cramton, *D. Lamar Deloach, et al. v. Philip Morris, Inc., et al.*, Civil Action No. 00-CV-1253, United States District Court, Middle District of North Carolina. October 2003. For R.J. Reynolds. Concluded that R.J. Reynolds did not collude in U.S. tobacco auctions during the class period.

Supplier Behavior in California Energy Crisis, Federal Energy Regulatory Commission, Docket Nos. EL00-95-075 and EL00-98-063, [“Competitive Bidding Behavior in Uniform-Price Auction Markets,”](#) March 2003. For Duke Energy.

Supplier Behavior in California Energy Crisis, Federal Energy Regulatory Commission, Docket Nos. EL00-95-075 and EL00-98-063, [“Rebuttal Addendum: Assessment of Submissions of the California Parties,”](#) March 2003. For Duke Energy.

U.S. Department of Transportation, Docket Nos. FAA–2001–9852, FAA–2001–9854, [“Comments on Alternative Policy Options for Managing Capacity and Mitigating Congestion and Delay at LaGuardia Airport.”](#) June 2002. Recommending auctions to manage congestion at LaGuardia.

Verizon Wireless Petition for Permanent Forbearance from CMRS Number Portability, Federal Communications Commission, WT Docket No. 01-184, [“Declaration of Peter Cramton.”](#) February 2002. Comments in support of wireless number portability. For Leap Wireless.

ISO New England, Docket No. ER02, Federal Energy Regulatory Commission, [“Affidavit of Peter Cramton.”](#) February 2002. Comments on proposed changes to how the energy clearing price is calculated. For ISO New England.

2000 Biennial Regulatory Review Spectrum Aggregation Limits For Commercial Mobile Radio Services, WT Docket No. 01-14, Federal Communications Commission, [“Ex Parte Declaration of Peter Cramton.”](#) October 2001. Further comments on the CMRS spectrum cap. For Leap Wireless.

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New England Power Pool, Docket No. OA97-237-000, Federal Energy Regulatory Commission, [“A Review of ISO New England's Proposed Market Rules,”](#) (with Robert Wilson), September 1998. For ISO New England.

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NextWave vs. Antigone and Devco, Petition to Deny License Proceedings, Federal Communications Commission, [“Reply Statement on the Effect of NextWave’s Participation in the C-block Auction on Antigone and Devco,”](#) April 1997. For Antigone and Devco.

### **Personal**

Born on 12 November 1957

Married to [Catherine Durnell Cramton](#)

## **Gregory L. Rosston**

### [Stanford Institute for Economic Policy Research](#)

Stanford University  
Stanford, CA 94305-6072  
Phone (650) 566-9211  
e-mail: grosston@stanford.edu  
greg@Rosston.com

### **Employment**

Stanford University, Stanford, CA

Deputy Director, Stanford Institute for Economic Policy Research, 1999-  
Deputy Director, Public Policy Program, 2006-  
Senior Research Fellow, Stanford Institute for Economic Policy Research, 2004-  
Research Fellow, Stanford Institute for Economic Policy Research, 1997-2004  
Lecturer in Economics/Public Policy, 1997-

Federal Communications Commission, Washington, DC

Deputy Chief Economist, 1995-1997  
Acting Chief Economist, Common Carrier Bureau, 1996  
Senior Economist, Office of Plans and Policy, 1994-1995

Law and Economics Consulting Group, Berkeley, CA

Senior Economist, 1990-1994

Economists Incorporated, Washington, DC

Economist/Research Associate, 1986-1988

### **Education**

Stanford University, M.A., Ph.D., in Economics, Specialized in the fields of  
Industrial Organization and Public Finance. 1986, 1994.

University of California, Berkeley, A.B. in Economics with Honors. 1984.

### **Papers and Publications**

“An Economic Analysis of the Effects of FCC Regulation on Land Mobile Radio,”  
unpublished Ph.D. dissertation, Stanford University. 1994.

“Competition in Local Telecommunications: Implications of Unbundling for  
Antitrust Policy” in Brock, G., (ed.) Toward a Competitive Telecommunication  
Industry: Selected Papers from the 1994 Telecommunications Policy Research  
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“The Effect of Private Interests on Regulated Retail and Wholesale Prices,”  
*forthcoming, Journal of Law and Economics*, August 2008 (with Savage, S. and  
Wimmer, B).

### **Policy Briefs and Opinion Pieces**

“On the Record: Former FCC Economist Backs Universal Service Alternative,”  
*Telecommunications Reports*, Vol. 63, No. 51. December 22, 1997, pp 51-53.

“[The Future of Wireless](#),” Stanford Institute for Economic Policy Research *Policy Brief*, May 2001.

“Politics Lands Bush in High Price Lane,” *Los Angeles Times*, June 15, 2001.

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Telecommunications Act of 1996](#),” Stanford Institute for Economic Policy Research  
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“[Writing the Right Ending to the MCI Saga](#),” *CNET.com* April 5, 2005.

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Freeways](#),” Stanford Institute for Economic Policy Research *Policy Brief*, April  
2005 (with Flamm, B.).

[“Humpty-Dumpty? Competitive Effects of the AT&T – BellSouth Merger,”](#)  
Stanford Institute for Economic Policy Research *Policy Brief*, March 2006.

[“Free Internet access in S.F. not the best deal for consumers,”](#) *San Jose Mercury News*, March 12, 2006.

### **Other Activities**

Referee for *American Economic Review*, *Rand Journal of Economics*, *Industrial and Corporate Change*, *Journal of Industrial Economics*, *Information, Economics and Policy*, *Telecommunications Policy*, *Telecommunication Systems*, *Journal of Economics and Management Science*, *Antitrust Law Journal*.

FCC Economist Panel on the Economics of Interconnection, May, 1996.

FCC Economist Panel on the Economics of RBOC Entry under §271, July, 1996.

FCC Economist Panel on Competitive Bidding for USF, March, 1997.

Consultant for the World Bank on Telecommunications Policy in Hungary, 1998.

FCC Academic Expert Panel on “A New FCC for the 21<sup>st</sup> Century,” June 1999.

FCC Academic Expert Panel on AT&T—MediaOne Merger, February, 2000.

FCC Panel on Wireless Competition, February 2002.

FCC Workshop on Spectrum Policy, July 2002.

San Francisco Telecom Commission on Cable Competition, January 2003.

U.S. Senate Commerce Committee on Spectrum Policy, March 2003.

California State Senate Committee on Banking, Commerce and International Trade on the Economic Effects of Media Consolidation, March 2003.

Telecommunications Policy Research Conference, Program Committee 2002-2004.

*Bay Area Economic Profile* Academic Review Panel, 2003-2004.

National Research Council Committee on *Wireless Technology Prospects and Policy*, 2003-2007.

San Francisco City Board of Supervisors Land Use Committee on Cable Competition, July 2004.

GAO Panel on Spectrum Allocation and Assignment, August, 2005.

FTC Panel on Network Neutrality, February 2007.

Sustainable Conservation, Advisory Board

Nepalese Youth Opportunity Fund, Advisory Board

### **Awards**

Chairman's Distinguished Service Award, FCC, 1997.

University of California, Brad King Award for Young Alumni Service, 1994.

National Performance Review Hammer Award for Reinventing Government, 1994.

Telecommunications Policy Research Conference Graduate Student Paper Competition, 2nd Place, 1994.

John M. Olin Foundation Fellowship, 1989-1990.

Charles Mills Gayley Fellowship, 1985.

Stanford University Fellowship, 1984-1985.

# Andrzej (Andy) Skrzypacz

CV August 2007

## Address

Stanford Graduate School of Business  
518 Memorial Way  
Stanford, CA 94305-5015

**E-mail:** andy@gsb.stanford.edu

**WebPage:** <https://gsbapps.stanford.edu/facultybios/bio.asp?ID=250>

**Phone:** (650) 736-0987    **Fax:** (650) 725-9932

**Date of Birth:** 02/06/1973

---

## Education

Ph.D. Economics, University of Rochester, October 2000.

M.A. Economics, University of Rochester, May 2000.

M.A. (magisterium) Economics, Warsaw School of Economics, Warsaw, Poland, 1997.

B.S. (licencjat) Economics, Warsaw School of Economics, Warsaw, Poland, 1995.

## Employment

Associate Professor of Economics, Stanford Graduate School of Business, since July 2004.

Assistant Professor of Economics, Stanford Graduate School of Business, July 2000-2004.

## Honors and Grants

Stanford GSB PhD Distinguished Service Award 2005

Best paper award, Utah winter finance conference 2004, joint with Peter DeMarzo and Ilan Kremer for "Bidding with Securities: Auctions and Security Design"

NSF Grant # 0318476 for a research project with Peter DeMarzo and Ilan Kremer "Bidding with Securities - Auctions and Security Design."

NSF Grant #0721090 for a research project with Christopher Phelan "'Beliefs and Private Monitoring,"

MBA Class of 1969 Faculty Scholar for 2002-2003

## **Research**

### **Published and Accepted Papers**

Yuliy Sannikov and Andrzej Skrzypacz (2007) "Impossibility of Collusion under Imperfect Monitoring with Flexible Production." Forthcoming in *American Economic Review*

Joseph E. Harrington, Jr. and Andrzej Skrzypacz (2005) "Collusion under Monitoring of Sales." Forthcoming in *Rand Journal of Economics*.

Ilan Kremer and Andrzej Skrzypacz (2005) "Dynamic Signaling and Market Breakdown." Forthcoming in *Journal of Economic Theory*

Matthew Mitchell and Andrzej Skrzypacz (2006) "Network Externalities and Long-Run Market Shares." *Economic Theory* 29 (3) pp. 621-648.

Yossi Feinberg and Andrzej Skrzypacz (2005) "Uncertainty about Uncertainty and Delay in Bargaining." *Econometrica* 73 (1) pp. 69-91.

Peter DeMarzo, Ilan Kremer and Andrzej Skrzypacz (2005) "Bidding with Securities: Auctions and Security Design." *American Economic Review* 95 (4), 936-959

Jerzy Konieczny and Andrzej Skrzypacz (2005) "Inflation and Price Setting in a Natural Experiment." *Journal of Monetary Economics* 52(3), pp. 621-632

Andrzej Skrzypacz and Hugo Hopenhayn (2004) "Tacit Collusion in Repeated Auctions." *Journal of Economic Theory* 114 (1), pp. 153-169.

### **Working Papers**

Yuliy Sannikov and Andrzej Skrzypacz (2006) "The role of information in repeated games with frequent actions." RR to *Econometrica*

Christopher Phelan and Andrzej Skrzypacz (2006) "Private Monitoring with Infinite Histories." RR to *Econometrica*

Ilan Kremer and Andrzej Skrzypacz (2006) "Information Aggregation and the Information Content of Order Statistics."

Matthew Mitchell and Andrzej Skrzypacz (2006) "Market Structure and the Direction of Technological Change."

Jerzy Konieczny and Andrzej Skrzypacz (2006) "Search, Costly Price Adjustment and the Frequency of Price Changes – Theory and Evidence." RR to *The B.E. Journals in Macroeconomics*

Qingmin Liu and Andrzej Skrzypacz (2006) "Reputation with Finite Monitoring."

William Fuchs and Andrzej Skrzypacz (2006) "Bargaining with Arrival of New Traders"

Ilan Kremer and Andrzej Skrzypacz (2004). “Auction Selection by an Informed Seller.”

### ***Main Professional Service***

Associate Editor for the American Economic Review.

### **PhD Students advised:**

As Principal Co-Advisor: William Fuchs (Chicago), Qingmin Liu (Penn), Yuliy Sannikov (Berkeley).

As Committee member: Simon Board (Toronto), Michael Grubb (MIT), Ayca Kaya (Iowa), Peter Lorentzen (Berkeley).

## **CURRICULUM VITAE**

October 2006

### **ROBERT B. WILSON**

Adams Distinguished Professor of Management, Emeritus  
Stanford Business School, Stanford, CA 94305-5015  
Tel: 650-723-8620. Fax: 650-725-7979. Home: 650-493-5340  
Email: RWilson@Stanford.edu, <<http://faculty-gsb.stanford.edu/wilson/>>

#### **EDUCATION AND DEGREES**

Harvard University	A.B. 1959, M.B.A. 1961, D.B.A.	1963
Norwegian School of Economics	honorary Doctor of Economics	1986
University of Chicago	honorary Doctor of Laws	1995

#### **ACADEMIC POSITIONS**

Stanford University, Graduate School of Business		
Assistant/Associate Professor	1964-1971; Professor	1971-1976
Atholl McBean Professor of Economics		1976-2000
Adams Distinguished Professor of Management		2000-2004
Adams Distinguished Professor of Management, Emeritus		2004-

#### **ACADEMIC AFFILIATIONS**

##### Scholarly Societies:

National Academy of Sciences: elected Member 1994-  
American Academy of Arts and Sciences: elected Fellow 1981-2004  
American Economic Association: named Distinguished Fellow 2006  
Econometric Society: elected Fellow 1976; elected Council member 1989-94;  
plenary speaker 1985, 1989, 1997; Fisher-Schultz Lecturer 1986; Vice-President  
and President 1997-1999; Executive Committee 1997-2000.  
Game Theory Society: Council member 2001–2005; Morgenstern Lecturer at  
2004 World Congress.

Fellowships: CORE, University of Louvain, Belgium, Visiting Professor 1967. Ford  
Foundation Faculty Research Fellow 1968. Center for Advanced Study in the  
Behavioral Sciences 1977-8. Guggenheim Fellowship 1982-3.

Research Programs: Stanford Center on Conflict and Negotiation 1987-2001; Director  
1990. Harvard Law School, Program on Negotiation, Affiliated Faculty 1993-  
2001. Stanford Institute for Theoretical Economics, Director 1993-5.

Associate Editor: *Econometrica* 1979-85. *Mathematics of Operations Research* 1988-  
90. *Journal of Risk and Uncertainty* 1987-91. *Journal of Regulatory Economics*  
1988-94. *Review of Economic Design* 1998-2002. *Games and Economic  
Behavior* 1988—. *Journal of Economic Dynamics and Control* 1995—2006.

Public Lectures: Norwegian School of Business and Economics, Borch Memorial  
Lecture 2004. Boston University, Rosenthal Memorial Lecture 1993. University of  
Oslo, Leif Johansen Award Program 1997. Tel Aviv University, Elisha Pazner  
Memorial Lecture 1997. Northwestern University, Nancy Schwartz Memorial  
Lecture 1994. Hebrew University of Jerusalem, Oskar Morgenstern Lecture  
1994. Helsinki School of Economics, Union Bank Lecture 1991. MIT, Inter-  
Session Lectures 1984.

## **PUBLICATIONS OF ROBERT WILSON**

### **DISSERTATION**

A Simplicial Algorithm for Concave Programming. Boston: Harvard Business School, 1963.

### **BOOK**

Nonlinear Pricing. New York: Oxford University Press, 1993. ISBN 0-19-506885-8. Paperback edition 1997.

Reviewed by Richard Schmalensee, *Journal of Political Economy*, December 1994, 102(6): 1288-1291; and by John C. Panzar, *Journal of Economic Literature*, September 1995, 33(3): 1339-1341. Selected by the editors of the *Journal of Business* as the 1995 winner of the Leo Melamed Prize, awarded biannually by the Graduate School of Business of the University of Chicago for "outstanding scholarship by a business professor."

### **EDITOR**

Barriers to Conflict Resolution. New York: W.W. Norton & Company, 1995. ISBN 0-393-03737-1. Co-edited with K. Arrow, R. Mnookin, L. Ross, and A. Tversky. Paperback edition published in 2000 by the Harvard Program on Negotiation, Cambridge, MA.

Co-winner of the 1995 Awards for Excellence Book Prize of the CPR Institute for Dispute Resolution.

Special Issue on Auction Design, co-edited with John McMillan and Michael Rothschild, *Journal of Economics and Management Science*, 1997.

Special Issue in Memory of Robert W. Rosenthal", co-edited with Andrew Postlewaite, *Games and Economic Behavior*, Vol. 45, No. 2 (November 2003).

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### **BOOK REVIEW**

Game and Economic Theory: Selected Contributions in Honor of Robert J. Aumann, University of Michigan Press, 1995; reviewed in *Games and Economic Behavior*, Vol. 21 (1997), pp. 322-324. [doi:10.1006/game.1997.0593](https://doi.org/10.1006/game.1997.0593)

### **ARTICLES** in chronological order

1. "Computation of Optimal Controls," *Journal of Mathematical Analysis and Applications*, Vol. 14, No. 1 (April 1966), pp. 77-82.
2. "On Programming under Uncertainty," *Operations Research*, Vol. 14, No. 4 (July-August 1966), pp. 652-657.

3. "Programming Variable Factors," *Management Science*, Vol. 13 (September 1966), pp. 144-151.
4. "Stronger Cuts in Gomory's All-Integer Integer Programming Algorithm," *Note, Operations Research*, Vol. 15, No. 1 (January, 1967), pp. 155-157.
5. "Exchange Equilibrium as a Budgetary Adjustment Process," *International Economic Review*, Vol. 8, No. 1 (February 1967), pp. 103-108.  
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6. "A Pareto-Optimal Dividend Policy," *Management Science*, Vol. 13, No. 9 (May 1967), pp. 756-764.
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8. "Optimal Dividend Policy," *Proc. Fourth International Conference on Operations Research*, D. Hertz and J. Melese (eds.), John Wiley & Sons, New York (1968), pp. 128-138.
9. "The Theory of Syndicates," *Econometrica*, Vol. 36, No. 1 (January, 1968), pp. 119-132.  
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10. "Decision Analysis in a Corporation," *IEEE Transactions on Systems Science and Cybernetics*, Vol. SSC-4, No. 3 (September 1968), pp. 220-226.
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13. "The Structure of Incentives for Decentralization under Uncertainty," *La Decision: Agregation et Dynamique des Ordres de Preference*, G. Guilbaud (ed.), pp. 287-307. Paris: Centre National de la Recherche Scientifique, 1969.
14. "Competitive Bidding with Disparate Information," *Management Science*, Vol. 15, No. 7 (March 1969), pp. 446-448. Reprinted in: Steven A. Lippman and David K. Levine (eds.), *The Economics of Information*, Edward Elgar Publishing, London, 1994; and P. Klemperer (ed.), *The Economic Theory of Auctions*, Edward Elgar Publishing, London, 1999.
15. "An Axiomatic Model of Logrolling," *American Economic Review*, Vol. 59, No. 3 (June 1969), pp. 331-341.  
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16. "Investment Analysis under Uncertainty," *Management Science*, Vol. 15, No. 12 (August 1969), pp. B650-B664. Reprinted in *Stochastic Optimization Models in*

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**5.5. ASSORTED RECENT PAPERS**      *in reverse*  
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- a. "On Forward Induction," co-authored with Srihari Govindan, December 2004; revised January 2007. Submitted to *Econometrica*. Available as Research Report 1955 and at SSRN: <http://ssrn.com/abstract=961852>.
- b. "A Decomposition Algorithm for N-Player Games," co-authored with Srihari Govindan, July 2005, revised August 2007. Submitted to *Economic Theory*. Available as Research Report 1967 and at SSRN: <http://ssrn.com/abstract=1007569>
- c. "Stable Outcomes of Generic Extensive-Form Games," co-authored with Srihari Govindan, December 2004; revised March 2006 and May 2007. Available as Research Paper 1933R and at SSRN: <http://ssrn.com/abstract=900185>.
- d. "Metastable Equilibria" co-authored with Srihari Govindan, November 2004; revised February 2006 and May 2007. Available as Research Paper 1934R and at SSRN: <http://ssrn.com/abstract=900612>. Formerly titled "Strengthening Best-Reply Stability by Invoking the Small Worlds Axiom".
- e. "Electricity Market Transformation: A Risk Management Approach", co-authored with Hung-po Chao and Shmuel Oren, Electric Power Research Institute, Palo Alto, CA, Report 1008549, April 2005.
- f. "Integrated Engineering and Economic Operation of Power Systems," co-authored with Shmuel Oren and Alex Papalexopoulos, Electric Power Research Institute, Palo Alto, CA, Report 1009483, January 2004.
- g. "Resource Adequacy and Market Power Mitigation via Option Contracts," co-authored with Hung-po Chao, July 2003. Submitted to *Journal of Regulatory Economics*; to be revised. Available as Chapter 1 of "Implementation of Resource Adequacy Requirements via Option Contracts," Report 1010712, Electric Power Research Institute, October 2005.
- h. "Axiomatic Equilibrium Selection in Outside-Option Games," and "Axiomatic Equilibrium Selection in Perfect-Information Games," co-authored with Srihari Govindan, March 2003.
- i. "Uniqueness of the Index for Nash Equilibria of Finite Games," co-authored with Srihari Govindan, July 1998; revised July 1999.
- j. "Design of Wholesale Electricity Markets," book manuscript co-authored with Hung-po Chao, 1999.

- k. "Hierarchical Pricing of Transmission," co-authored with Hung-po Chao, Shmuel Oren, and Stephen Peck, May 2001.
- l. "Efficiency Considerations in Designing Electricity Markets," report to the Competition Bureau of Industry Canada, March 1998.
- m. "Activity Rules for the Power Exchange" and "Priority Pricing of Ancillary Services," reports to the California PX and ISO Trusts for Power Industry Restructuring, March and May, 1997.
- n. "Auctions of Stranded Power Assets," May 1996 (LEES Working Paper, School of Engineering, MIT), and "Auctions of Transmission Capacity Reservations," November 1996, filings to the Massachusetts DPU and Attorney General, and the Federal Energy Regulatory Commission.
- o. "Multi-Unit Auctions," co-authored with Hung-po Chao, November 1995.
- p. "Auction Design for Standard Offer Service," co-authored with Peter Cramton and Andrew Parece, September 1997.

## APPENDIX B: D BLOCK REQUIREMENTS

**Technical Requirements-** network must incorporate at a minimum the following:

- Specifications for a broadband technology platform that provides mobile voice, video, and data capability that is seamlessly interoperable across agencies, jurisdictions, and geographic areas. The platform should also include current and evolving state-of-the-art technologies reasonably made available in the commercial marketplace with features beneficial to the public safety community (*e.g.*, increased bandwidth).
- Sufficient signal coverage to ensure reliable operation throughout the service area consistent with typical public safety communications systems (*i.e.*, 99.7 percent or better reliability).
- Sufficient robustness to meet the reliability and performance requirements of public safety. To meet this standard, network specifications must include features such as hardening of transmission facilities and antenna towers to withstand harsh weather and disaster conditions, and backup power sufficient to maintain operations for an extended period of time.
- Sufficient capacity to meet the needs of public safety, particularly during emergency and disaster situations, so that public safety applications are not degraded (*i.e.*, increased blockage rates and/or transmission times or reduced data speeds) during periods of heavy usage. In considering this requirement, we expect the network to employ spectrum efficient techniques, such as frequency reuse and sectorized or adaptive antennas.
- Security and encryption consistent with state-of-the-art technologies.
- A mechanism to automatically prioritize public safety communications over commercial uses on a real-time basis and to assign the highest priority to communications involving safety of life and property and homeland security consistent with the requirements adopted in this Second Report and Order.
- Operational capabilities consistent with features and requirements specified by the Public Safety Broadband Licensee that are typical of current and evolving state-of-the-art public safety systems (such as connection to the PSTN, push-to-talk, one-to one and one-to-many communications, etc.).
- Operational control of the network by the Public Safety Broadband Licensee to the extent necessary to ensure public safety requirements are met.
- The Public Safety Broadband Licensee shall have the right to determine and approve the specifications of public safety equipment that is used on the network, and the right to purchase its own subscriber equipment from any vendor it chooses, to the extent such specifications and equipment are consistent with reasonable network control requirements established in the NSA.
- A requirement, as explained more fully herein, that the Upper 700 MHz D Block licensee make available to the Public Safety Broadband Licensee at

least one handset that would be suitable for public safety use and include an integrated satellite solution capable of operating both on the 700 MHz public safety spectrum and on satellite frequencies.

***Stringent Build-Out Requirements***

- The Order requires 99.3% of the population to be covered within 10 years
  - 75% within 4 years
  - 95% within 7 years
- Public safety and D Block licensee can agree to modify these requirements with Commission approval in limited circumstances

## APPENDIX C: Alternative Reserve Price Approach

A different approach that the Commission may find attractive in setting the reserve prices for Blocks A, B, C and E (but in our opinion inferior to the recommendations above) is as follows:

1. In the re-auction set low reserve prices on the level that we recommend above and in line with previous practice. This can avoid the disaster of the 3<sup>rd</sup> auction.
2. If the idea of auction and re-auction is to test if the additional restrictions are not destroying too much value, the Commission should state explicitly how much value it assigns to these restrictions. For example, for the A, B and E Blocks, state the value of offering additional coverage and for the C Block determine the value of having the open access provisions.
3. Then, the Commission would need to estimate the revenues from the auction without the additional restrictions. In the estimation it is important to take into account the change in the cost of capital and macroeconomic conditions that we discussed in Section 1.1. In particular, the expected revenues should be lower than the revenues from the AWS auction.
4. Using our arguments above, one can then calculate the basis for the reserve prices in the original auction as a difference between the expected revenues in step 3 and the values in step 2. For example, if the Commission placed a value of \$1 billion on openness for the C Block, then it would set a reserve price for the C Block of \$1 billion less than the expected revenue without the openness restrictions, not at a level equal to the expected revenues as the Commission has attempted to do.
5. To let the market play a more important role, it would be advisable to offer the licenses in Blocks A, B, and E on a license-by-license basis rather than with aggregate reserves, since it may be efficient to have some of the auctions with the additional restrictions and others without. The C Block openness restrictions make sense to be imposed on the nationwide level, hence it makes sense to impose the reserve for the aggregate block.

If this reasoning is adopted, the D Block should be structured differently because in the case of this block the Commission is not testing whether the requirements should be relaxed: the public safety network should be started as soon as possible and there is relative agreement about the coverage and service requirements on that network. Hence, it makes no sense to start with a higher reserve price on D that could be reduced in the re-auction. To guarantee the most competition and timely awarding of this license it is necessary to set the reserve for the D Block using the previous practice of about 20% of expected revenues. While the reserve would appear low, the winner of this license will pay closer to the expected revenues and will continue paying to the public good long after the auction by building out the public safety network. The idea of sacrificing some of the revenue to pay for the public safety network is at the core of the creation of the public-private partnership and the Commission should not jeopardize that partnership by setting unreasonably high reserve on the D Block.

**Attachment B:  
Technical Statement  
Estimated Expenses for D Block Coverage Requirements  
Frontline Wireless, LLC**

The following estimates in numbers 1 through 3 below are based on figures submitted in two *ex parte* filings by Cyren Call, which we assume solely for purposes of the valuations offered here. See Cyren Call Ex Parte, WT Docket No. 06-150 (July 9, 2007), at 3, 5 & 13; Cyren Call Ex Parte, WT Docket No. 06-150 (July 19, 2007), at 4, 8.

**1. Geographic coverage requirements**

- 75% “substantial service” population-based coverage requirement: approx. 11% U.S. land mass coverage, or **396,000** square miles
- 99.3% population-based coverage requirement: approx. 63% U.S. land mass coverage, or approx. **2,234,000** square miles
- =  $\uparrow$  **1,838,000** square miles of coverage (573% increase; most if not all in rural areas)

**2. Cell site capacity**

- estimated hexagonal coverage area of a rural cell site: **110** square miles

**3. Cell site build out requirements**

- **37,000** cell sites required to meet D Block requirements

**4. Incremental cell sites required for D Block coverage**

- an additional **16,710** cell sites (**1,838,000** square mileage coverage increase/**110** square miles per site)

**5. Increase in number of cell sites needed for D Block coverage over C Block coverage**

- **37,000** – **16,710** [number of incremental cell sites required for D Block coverage]
- = **20,290** cell sites needed for C Block coverage
- **16,710/20,290**

= **82%** increase in cell sites required for D Block coverage

**6. Cost of cell site build out**

- approx. cost of each cell site: **\$250-300,000**<sup>1</sup>
- **\$300,000** [cost per cell site]
- x **16,710** [number of additional sites needed to fulfill D Block coverage requirement]

= **\$5 billion**

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<sup>1</sup> This calculation will assume \$300,000 for the cost of a single cell site. However, cell site building costs for the D Block network will be considerably higher than \$300,000 due to hardening against natural disasters and other operability requirements that public safety’s use will require.

**Attachment C:**

Public Notice:

*Wireless Telecommunications Bureau Clarifies*

*Spectrum Auction Anti-Collusion Rules*

11 FCC Rcd 9645; 1995 FCC LEXIS 7012 (Oct. 26, 1995)

LEXSEE 1995 FCC LEXIS 7012

Wireless Telecommunications Bureau Clarifies Spectrum Auction Anti-Collusion Rules

[NO NUMBER IN ORIGINAL]

FEDERAL COMMUNICATIONS COMMISSION

*11 FCC Rcd 9645; 1995 FCC LEXIS 7012*

**RELEASE-NUMBER:** DA 95-2244

October 26, 1995

**ACTION:** [\*1] PUBLIC NOTICE

**OPINION:**

The Wireless Telecommunications Bureau has received numerous inquiries concerning the Commission's auction rules and eligibility requirements for the various spectrum auctions. This Public Notice, in which the Bureau provides guidance regarding the Commission's anti-collusion rules, is meant to serve as a guideline for all auctions.

The Commission established its anti-collusion rules in order to enhance the competitiveness of the auction process and of the post-auction market structure. See Second Report and Order in *PP Docket No. 93-252, 9 FCC Rcd 2348, 2387 (1994)* ("Second R&O"). The Commission's anti-collusion rules require an applicant to identify on its short-form application all parties with whom it has entered into a bidding consortium or other joint bidding arrangement. After the short-form filing deadline, applicants may not discuss the substance of their bids or bidding strategies with bidders, other than those identified on the short-form application, that are bidding in the same geographic license areas. 47 C.F.R. § 1.2105(c)(1); Fourth Memorandum Opinion & Order in *PP Docket No. 93-253, 9 FCC Rcd 6858, 6868 (1994)* [\*2] ("Fourth MO&O"). The post-deadline prohibition on discussions extends to providing indirect information that affects bids or bidding strategy. Letter to R. Michael Senkowski from Rosalind K. Allen, Acting Chief, Commercial Radio Division, released Dec. 1, 1994. The geographic license area is the market designation of the particular services, e.g., MTA, BTA, and EA. For example, two applicants not listed on each other's short-form applications for the 900 MHz SMR auction may not discuss bids or bidding strategies with each other if they are bidding for licenses in any of the same MTAs, even if they are not bidding for the same frequency blocks.

If an applicant has the high bid for a license, the applicant must include with its long-form application a detailed explanation of the terms and conditions and parties involved in a bidding agreement into which it has entered. 47 C.F.R. § 1.2107(d). It is important to note that for purposes of the Commission's anti-collusion rules, the term applicant includes the entity submitting the application, owners of 5 percent or more of the entity, and all officers and directors of that entity. 47 C.F.R. § 1.2105(c)(6)(i).

If parties agree in principle [\*3] on all material terms, those parties must be identified on the short-form application under Section 1.2105(c), even if the agreement has not been reduced to writing. Only at such level of agreement can it be fairly stated that the parties have entered into a bidding consortium or other joint bidding arrangement. If the parties have not agreed in principle by the filing deadline, an applicant would not include the names of those parties on its application, and may not continue negotiations with those parties.

There are three exceptions to the rule prohibiting discussions with other applicants after the filing of the short-form application. First, an applicant may modify its short-form application to reflect formation of bidding agreements or changes in ownership at any time before or during the auction, as long as the changes do not result in change of control of the applicant, and the parties forming the bidding agreement have not applied for licenses in any of the same geographic license areas. 47 C.F.R. § 1.2105(c)(2). Applicants may also make agreements to bid jointly for licenses, so long as the applicants have not applied for licenses in any of the same geographic license areas. [\*4] 47 C.F.R. § 1.2105(c)(3). Finally, a holder of a non-controlling attributable interest in an applicant may acquire an ownership interest in, or enter into a bidding agreement with other applicants in the same geographic license area, if (1) the owner of the attributable interest certifies that it has not communicated and will not communicate bids or bidding strategies of

more than one of the applicants in which it holds an attributable interest or with which it has a bidding agreement; and (2) the arrangements do not result in any change of control of an applicant. 47 C.F.R. § 1.2105(c)(4).

Where the applicant does not meet one of these exceptions, it may not discuss matters relating to bidding with other applicants. Even when an applicant has withdrawn its application after the short-form filing deadline, the applicant may not enter into a bidding agreement with another applicant bidding on the geographic license areas from which the first applicant withdrew. *Fourth MO&O, 9 FCC Rcd at 6867*. In addition, once the short-form application has been filed, a party with an attributable interest in one bidder may not acquire a controlling interest in another bidder [\*5] bidding for licenses in any of the same geographic license areas.

Even where the applicant discloses parties with whom it has reached an agreement on the short-form application, thereby permitting discussions with those parties, the applicant is nevertheless subject to existing antitrust laws. *Fourth MO&O, 9 FCC Rcd at 6869 n.134*. As discussed in the Fourth MO&O, under the antitrust laws, the parties to an agreement may not discuss bid prices if they have applied for licenses in the same geographic market. In addition, agreements between actual or potential competitors to submit collusive, non-competitive or rigged bids are per se violations of Section One of the Sherman Antitrust Act. *Id.* Further, actual or potential competitors may not agree to divide territories horizontally in order to minimize competition, regardless of whether they split a market in which they both do business, or whether they merely reserve one market for one and another for the other. *Id.*

To the extent the Commission becomes aware of specific allegations that may give rise to violations of the federal antitrust laws, the Commission may investigate and/or refer such allegations [\*6] to the United States Department of Justice for investigation. Bidders who are found to have violated the antitrust laws or the Commission's anti-collusion rules in connection with participation in the auction process may, among other remedies, be subject to the loss of their down payment or their full bid amount, cancellation of their licenses, and may be prohibited from participating in future auctions. *Second R&O, 9 FCC Rcd at 2388*.

For additional information regarding this Public Notice, please contact Aaron Goldschmidt in the Wireless Telecommunications Bureau, at (202) 418-0660, or Deborah Klein in the Office of General Counsel, at (202) 418-1880.