

## COMMENTS ON THE FCC EXPERIMENTAL AUCTION DESIGN REPORT

PA Consulting Group commends the principle of experimenting before a real auction; this in itself will be a great help. However, there are a number of issues to be resolved, as noted in our comments below.

1. [Page 1] - The sample population for economic experiments may well be different from the population of real-world decision makers for spectrum auctions. Either by screening out candidates with extensive knowledge of game theory, or by introducing candidates to the subject with little preparation. In practice we would expect to find that significant amounts of analysis (including consultation with experts) takes place prior to an auction.
2. [Page 5] - The distributional approach to package valuation could generate unusual or contradictory valuations. It would be worth setting up a set of reasonable condition flags (such as an additional licence reducing the value of a package) and running a Monte Carlo simulation across the valuation distributions to check for any unacceptable valuation sets.
3. [Page 8] - A good strategy would be to bid for the package (or set of packages) that maximises the "value gap" between a player's valuation and the current prices. It would be possible to simulate auctions using entirely rule-based strategies for comparison against live decision makers. It would also be interesting to see how the introduction of a rule-based agent influences the course of an auction with live decision makers.
4. [Page 12] - The table appears to be incomplete. Should there be X's in the Full Disclosure column for rows 4 to 8?
5. [Page 12] Why have 5 of the 16 potential combinations been excluded?
6. [Page 12] We would suggest repeating the auction with the same distribution samples to explore the effects of repetition and the robustness of the final allocation of packages.
7. [Page 12] Where are subjects to be recruited from? Recruiting over 1000 subjects sounds a significant challenge, particularly if there is a requirement for some previous economic / game theoretic experience.
8. [Page 12] Will earnings for the subjects be linked to their performance in the auctions?
9. [Page 13] Is there a risk that the distributional valuations will add volatility to the measure of efficiency for the same assignment of packages?
10. [Page 13] We would suggest including price as a performance measure, for example prices paid as a ratio of the maximum valuation. This is equivalent to the "economic efficiency" if all winning bidders are paying their maximum valuation.
11. [Page 15] - In the competitive equilibrium each player has their preferred allocation and (since further bidding can only increase prices) no player can unilaterally improve their allocation. Does this equilibrium represent a Nash equilibrium of a single round auction?

12. [Page 15] - It would be worth running repeated experiments on this example to see what end states are reached.
13. [Page 15] The use of Linear Programming to calculate Current Prices effectively make the rules a black box for players, as in complex situations you cannot easily predict which bids will win. This must have a detrimental effect on the players tactical decision making. A more transparent package allocation method may encourage more efficient equilibria in practice, that could offset the lack of optimality in the choice of package allocation.
14. [General] Some investigation of the bidding / decision-making process would be valuable. In the 3G auctions in the UK, there seemed to be a bidder reluctance to give up - ' we've personally invested time and effort into this and we want to "win". How do companies think in these situations?

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### **Dr Phil White**

Dr Phil White joined PA in 1985, and is now Practice Head of PA's Wireless Technology Practice and a member of PA Strategy Partners registered for providing corporate financial advice. His role within PA involves management of major assignments, business development, and leadership of PA's wireless technology business.

Dr White has worked extensively in the wireless industry, helping vendors and operators develop, implement and take advantage of new wireless communications technology. He was responsible for advising one of the license bidders in the UK's 3G elections, constructing the revenue and cost models for the new network in order to arrive at a bid limit. More recently he has been involved in assessing the value impact of new technologies on existing wireless spectrum users. He is an acknowledged expert on mobile communications and frequently contributes to conferences, publications and public broadcasts. Some of his recent contributions include publications on GSM and 3G technology development, new technologies in Europe, and likely scenarios for 3rd generation mobile communications.

### **Jonathan Cook**

Jonathan Cook joined PA's Management Sciences group in 1996 following completion of his Ph.D. in signalling game models of the auditing process at Edinburgh University. He is a Managing Consultant in the Decision Sciences practice.

Jon has worked in Utilities, Pharmaceuticals, Telecoms and the Public Sector. He is an experienced management scientist, specialising in techniques such as simulation, forecasting, game theory, linear programming and financial modelling. He has a thorough technical knowledge of Visual Basic and Excel, having developed a number of models using these applications.