

Hogan Qualifying Exam Reading List - Last Updated February 6, 2007

My research involves exploring alternative methods of capacity allocation for handling demand imbalances in the National Airspace System. My focus is on the en-route environment and taking advantage of the inherent preferences users have in their decisions with respect to the routes in the airspace that they access and the times, altitudes, and equipment specific to their use of routes. The basic idea of congestion pricing is interesting, that users are charged in proportion to the cost externalities of the delay produced by their additional use of the system. The application of this theory may be less feasible in the en-route airspace domain, but the concept of dynamically charging users for the ways in which they access the system could be very effective. Specifically, a system of providing users incentives to behave in ways that are beneficial to the efficiency of the overall system could be an effective technique for demand management. For example, the current tax structure for the FAA that is linked to passengers transported and the fares they paid is a missed opportunity to incentivize good behavior since transporting the same number of passengers on smaller, more frequent aircraft generates more demand on the system but doesn't cost users any more to do it. Consider the alternative in which actions that increase the use of heavily demanded resources cost users proportionally more for that access, and incentives are provided to users who offload from those busy routes and times. This new line of thinking about traffic flow management is the motivation for my research.

This document contains a breakdown of literature by topic for my qualifying exam, tentatively scheduled for February 2007. I feel that each of these topics and the papers within them, would further prepare me to complete a dissertation in the area of airspace demand management through congestion pricing and user incentives. Specifically, the major area "Decision Support Tools for Capacity Allocation Problems" will help ensure that I am thinking about the systems level issues of the problem I am trying to solve. In any decision support system, the human-automation interface is critical to the effectiveness of the tool. It is important to think about the environment in which the tool is operating and the nature of how humans work with the tool. The first subtopic will ensure that I am aware of these issues while implementing my dissertation research. Regarding my desired objective of efficient capacity allocation, the decision support tools mentioned above will likely involve auctions or another form of experimental economics. This second subtopic will help ensure that I am drawing on the principles of economic efficiency as well as implementation methods from the prior literature.

Another possible thrust for this research would be the implementation of a dynamic pricing scheme for capacity allocation. The first minor area will ensure that I am prepared with the necessary stochastic optimization toolset, and that I am familiar with the congestion-motivated pricing research from other industries as well. The second minor area in response surface methodology will serve as background for common themes across many of the topics mentioned. Useful aspects for my research could include experimental design, screening of important variables, as well as seeking an optimum in a complex system environment.

For more information on the motivation for this research, go to <http://www.people.virginia.edu/~bph4r>

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Major Area: Decision Support Tools for Capacity Allocation Problems

Human-Automation Interaction in Stochastic Domains - Professor Ellen Bass

- Adelman, Leonard, Matthew Christian, James Gualtieri and Karen L. Johnson (1998). "Examining the Effects of Cognitive Consistency Between Training and Displays". In: *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans* 28.1 (Jan. 1998). 1-16.
- Bainbridge, Lisanne (1983). "Ironies of Automation". In: *Automatica* 19.6. 775-779.
- Bisantz, Ann M., and Amy R. Pritchett (2003). "Measuring the Fit between Human Judgements and Automated Alerting Algorithms: A Study of Collision Detection". In: *Human Factors* 45.2. 266-280.
- Kirlik, Alex (1993). "Modeling strategic behavior in human-automation interaction - Why an 'aid' can (and should) go unused". In: *Human Factors* 35.2 (June 1993). 221-242.
- Smith, Philip J., C. Elaine McCoy and Charles Layton (1997). "Brittleness in the Design of Cooperative Problem- Solving Systems: The Effects on User Performance". In: *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans* 27.3 (May 1997). 360-371.
- Tversky, Amos, and Daniel Kahneman (1974). "Judgement under Uncertainty: Heuristics and Biases". In: *Science* 185.4157 (Sept. 1974). 1124-1131.
- Yang, Lee C., and James K. Kuchar (2002). "Performance Metric Alerting: A New Design Approach for Complex Alerting Problems". In: *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans* 32.1 (Jan. 2002). 123-134.

Auctions and Experimental Economics for Capacity Allocation - Professor Alfredo Garcia

- Brueckner, Jan K. (2004). “Network Structure and Airline Scheduling”. In: *Journal of Industrial Economics* 52.2 (June 2004). 291–312.
- Erev, Ido, Greg Barron and Roger Remington (2004). “Right of Way in the Sky: Two Problems in Aircraft Self-Separation and the Auction-Based Solution”. In: *Human Factors* 46.2. 267–276.
- Grether, David M., R. Mark Isaac and Charles R. Plott (1989). “The allocation of scarce resources: Experimental economics and the problem of allocating airport slots”. In: *Underground Classics in Economics Series*. ISBN 0-8133-7543-6. Westview Press.
- Hendricks, Ken, Michele Piccione and Guofu Tan (1999). “Equilibria in Networks”. In: *Econometrica* 67.6 (Nov. 1999). 1407–1434.
- Vossen, Thomas W. M., and Michael O. Ball (2006). “Slot Trading Opportunities in Collaborative Ground Delay Programs”. In: *Transportation Science* 40.1 (Feb. 2006). 29–43.

Minor Area 1

Methods for Dynamic Pricing - Professor Steve Patek

- Bertsekas, Dimitri P., and John N. Tsitsiklis (1996a). “Neuro-Dynamic Programming”. In: Athena Scientific. Chap. 3: Neural Network Architectures and Training. 59–130.
- (1996b). “Neuro-Dynamic Programming”. In: Athena Scientific. Chap. 4: Stochastic Iterative Algorithms. 131–178.
- Campos-Náñez, Enrique, and Stephen D. Patek (2004). “Dynamically Identifying Regenerative Cycles in Simulation-Based Optimization Algorithms for Markov Chains”. In: *IEEE Transactions on Automatic Control* 49.6 (June 2004). 1022–1025.
- Lin, Xiaojun, and Ness B. Shroff (2006a). “An Optimization-Based Approach for QoS routing in High-Bandwidth Networks”. In: *IEEE/ACM Transactions on Networking* 14.6 (Dec. 2006). 1348–1361.
- (2006b). “Utility Maximization for Communication Networks With Multipath Routing”. In: *IEEE Transactions on Automatic Control* 51.5 (May 2006). 766–781.
- Luenberger, David G. (2003). “Linear and Nonlinear Programming”. In: 2nd ed. Springer. Chap. Selected material on gradient methods and unconstrained optimization.
- Paschalidis, Ioannis Ch., and John N. Tsitsiklis (2000). “Congestion-dependent pricing of network services”. In: *IEEE/ACM Transactions on Networking* 8.2. 171–184. ISSN 1063-6692.

Minor Area 2

Response Surface Methodology for Complex Systems - Professor Donald Brown

- Crino, Scott T., and Donald E. Brown (2007). “Global Optimization with Multivariate Adaptive Regression Splines”. In: *Forthcoming*.
- Myers, Raymond H., and Douglas C. Montgomery (2002). *Response Surface Methodology: Process and product optimization using designed experiments*. Wiley Series in Probability and Statistics. John Wiley & Sons, Inc.
- Schamburg, Jeffrey B., and Donald E. Brown (2004). “A generalized multiple response surface methodology for complex computer simulation applications”. In: *Proceedings of the 2004 Winter Simulation Conference*. Ed. by R. G. Ingalls, M. D. Rossetti, J. S. Smith and B. A. Peters. Washington, DC. 958–966.