MICHAEL OWEN BALL

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Web site: **http://scholar.rhsmith.umd.edu/mball**
Citations: https://scholar.google.com/citations?hl=en&view_op=list_works&gmla=AJsN-F6AMKefGu5XFd6kv7Bz852mIQnVremKS5GoHMPJvrhequeFyKbSRnU4Mo-SmWM-xnT-SdZIVeAJw7DqgPiYj9zA5BASnw&user=d07vxcgAAAAJ

PROFESSIONAL INTERESTS

Operations research.
Transportation science, especially air traffic management.
Supply chain management and revenue management.
Network and combinatorial optimization.
Network reliability analysis.

EDUCATION

PhD   Operations Research, Cornell University, 1977.
MSE   Operations Research, Johns Hopkins University, 1972.
BES   Engineering Science, Johns Hopkins University, 1972 (Phi Beta Kappa, Tau Beta Pi, general and departmental honors).

ACADEMIC EXPERIENCE

8/90-present   Dean's Chair in Management Science, Robert H Smith School of Business, University of Maryland, College Park (9/12-present); Orkand Corporation Professor of Management Science (8/01-9/12); Interim Dean, Smith School (7/13-8/13); Senior Associate Dean, Smith School (12/13-8/18; 8/19-present); Associate Dean for Faculty and Research, Smith School (8/10 – 12/13); Associate Dean for Research, Smith School (8/09 – 8/10); Director of Research, Smith School (6/98 – 8-09); Acting Director, Center for Knowledge and Information Management (6/98 – 6/00); Co-Chair of Decision and Information Technologies (5/98 - 5/99); Chair, Management Science and Statistics (1/96 - 5/98); Co-Director, NEXTOR/NEXTOR-II, the National Center of Excellence for Aviation Operations Research (5/96 – present).

8/15-8/16   Visiting Professor, Institute of Transportation Studies, University of California, Berkeley.

8/07-8/08   Visiting Professor, Institute of Transportation Studies, University of California, Berkeley.

8/92-7/93   Visiting Professor; Department of Operations Research, University of North Carolina at Chapel Hill.

8/88-7/90   Professor; College of Business and Management, University of Maryland, College Park.

8/88-present   Joint appointment: System Research Center/Institute for Systems Research, Clark School of Engineering

8/84-8/88   Associate Professor; College of Business and Management, University of Maryland, College Park.

8/84-8/85	Visiting Associate Professor; Department of Combinatorics and Optimization and Department of Management Sciences, University of Waterloo, Waterloo, Ontario.
8/79-8/84	Assistant Professor; College of Business and Management, University of Maryland, College Park.
9/78-8/79	Visiting Assistant Professor; College of Business and Management, University of Maryland, College Park.
9/75-9/76	Research Assistant; Center for Operations Research and Econometrics, University of Louvain, Louvain, Belgium.

INDUSTRIAL AND CONSULTING EXPERIENCE

8/80-9/98	Co-founder of Distinct Management Consultants and its subsidiary Routesmart Technologies; held various offices within these organizations, including president; led several projects; the companies provided consulting services and developed routing and scheduling software products; the software products achieved significant market penetration in the sanitation and meter reading marketplaces; companies sold in 1998.
2/79-present	Major Consulting Clients:

Distribution and Transportation Systems
GRC, United States Postal Service, Southern California Gas Co., Military Airlift Command, United Parcel Service, Roadnet Technologies, Inc., Sage Management Consultants, Norfolk and Western Railroad, Southeastern Pennsylvania Transit Authority, Blue Bell, Inc., Rohm and Haas Pharmaceutical Co.

Telecommunications Systems
Sprint International, CACI, Inc.

Manufacturing Systems
Simmons USA.

Air Traffic Management
Los Angeles World Airports, The Boeing Company, Federal Aviation Administration, GRA, Inc., Crown Consulting, The Port Authority of New York and New Jersey.

10/76-9/78	Member of Technical Staff; Bell Laboratories.
6/74-8/74	Scientific Programmer; Network Analysis Corporation.
6/73-8/73	Program Analyst; U.S. Environmental Protection Agency.

EXPERT PANELS AND COMMISIONS

2017- 2019	Member of the Advisory Board, "Engage" Knowledge Transfer Network
2016 – 2018	Member of the Advisory Board of OR-MASTER (Mathematical Models and Algorithms for Allocating Scarce Airport Resources Project)
2015- 2018	Member of the Competition for Air Traffic Management (Compair) Advisory Board.
2011 – 2012	Member of the Independent Experts Operational Goals Group (IEOGG) of the Committee on Aviation Environmental Protection (CAEP). CAEP is part of the International Civil Aviation Organization, which is part of the United Nations.
2008 - 2010	Member of Academic Panel: Los Angeles World Airports; oversaw North Airfield Safety Study.
2009 - 2010	Member of Expert Panel: NextGen Flight Prioritization "Deep Dive".

2009 – 2010   Member of National Research Council Panel: Review of Air Traffic Control Enroute Complexity Model.

RESEARCH CONTRACTS AND GRANTS

6/20-present   FAA: "NEXTOR-III: FAA Consortium in Aviation Operations Research"; Principal Investigator and co-Director; participating schools: U of MD, MIT, UC Berkeley, VPISU, George Mason University, Georgia Tech, Ohio State, Purdue; total funding: ~ $1.5M per year; leader of several projects, especially in areas of traffic flow management and collaborative decision making.

9/15-8/18   NASA: "Decision Support Capabilities For Effective Application Of Collaborative Trajectory Options Programs", PI: Hoffman (Metron Aviation), coPIs: Ball, Hansen (UC Berkeley), Smith (Ohio State); $339,000 for 3 years (UMD portion).

8/14-12/18   NASA: "Similar Historical Days and Air Traffic Flow Management"; PI: Hansen (UC Berkeley), coPIs: Ball, Lovell, Schade (ATAC Corp); $405,000 for 3 years (UMD portion)

5/11-6/20   FAA: "NEXTOR-II: FAA Consortium in Aviation Operations Research"; Principal Investigator and co-Director; participating schools: U of MD, MIT, UC Berkeley, VPISU, George Mason University, Georgia Tech, Ohio State, Purdue; total funding: ~ $2M per year; leader of several projects, especially in areas of traffic flow management and collaborative decision making.

10/2006-9/2010   NASA: "Dynamic, Stochastic Models for Managing Air Traffic Flows", PI: Ball, coPIs: M. Hansen, R. Hoffman, D. Lovell, A. Odoni, H. Sherali,; $2,100,000 for 3 years

1/2006-12/2009   NSF; "Dynamic Real-Time Order Promising and Fulfillment for Global Make-to-Order Supply Chains", PI: Ball, coPI: Fu; $630,000 for 3 years.

5/2003-12/2004   Dell Computer Corporation; "Optimization Based Order Promising", PI: Ball, coPI: Zhao; $25,000 for 9 months.

7/2001-12/2005   NSF; "Rapid Response Electronic Markets for Time Sensitive Goods", PI: Anandalingam, co-PIs: L. Ausubel, M. Ball, H. Lucas, V.S. Subrahmanian; $2,000,000 for 3 years.

5/2001-2004   Toshiba Corporation; Research in Digital Manufacturing and Supply Chain Management – specific projects: 1) optimization-based production planning; 2) advanced available-to-promise; 3) production capability planning; 4) production loading; $150,000 for 3 years.

9/2000-2004   NSF; "Combined Research and Curriculum Development in Systems Engineering"; PI: Baras, co-PIs: Austin, Hermann, Schmidt, Ball; $500,000 for 3 years.

9/99-5/2001   NSF; "Formulating Redesign Strategies for Product Evolution: a Proactive Approach to Managing Technological Innovation", PI: Gupta, co-Pis: Ball, Nau; $285,056 for 3 years.

9/99-3/2001   NSF; "Scalable Supply Chain Infrastructures: Models and Analysis", PI: Ball, co-PIs: S.Boyson, L. Raschid, V. Sambamurthy; $945,237 for 3 years.

8/96-5/11   "NEXTOR: National Center of Excellence for Aviation Operations Research"; Co-principal Investigator and co-Director; center of excellence funded by Federal Aviation Administration and Industry; participating schools: U of MD, MIT, UC Berkeley, VPISU, George Mason University; total funding: $2M -- $5M per year; leader of several projects, especially in areas of traffic flow management, collaborative decision making and airport congestion management.

1/98-1/2002	Northrup Grumman Corp; "Design-to-Cost Optimization"; PI: Ball, co-PI: Nau; Amount: $150,000 (3 years).
3/97-8/98	Northrup Grumman Corp; "Integrated Process and Product Design"; PI: Baras; co-PIs: Ball, Minis, Nau.; Amount: $60,000 + state matching.
2/96-8/97	Participant in projects on network management funded by Army Research Laboratory through Army Federated Laboratory grant.
3/93-3/94	Loral; "Automated Fault Management"; co-principal investigators: George Atallah, Michael Ball and John Baras; Amount: $130,000 + state matching.
3/92-3/93	Hughes Network Systems; "Next Generation Network Management Systems"; co-principal investigators: George Atallah, Michael Ball, John Baras, Catherine Plaisant, Nick Roussopoulos, Ben Shneiderman; Amount: $140,000 + state matching.
8/92-8/95	IBM Corporation; "Topics in Network Design"; Amount: $62,000.
8/90-8/97	Participant in projects in the areas of systems integration, network management and design and manufacturing funded by NSF through the Systems Research Center ERC grant.
1/88-8/90	United Parcel Service; "Parallel Algorithms for Routing and Scheduling"; co-principal investigators: Michael Ball and Lawrence Bodin; Amount: $26,000.
4/85-12/87	U.S. Army Research Office; "The Development of a Computer Code for the Solution of Large Scale Network Reliability Problems"; Amount: $106,000.
7/84-12/86	Westinghouse Electric Corporation; "Reliability Analysis of Command and Control Systems"; co-principal investigators: Arjang Assad, Michael Ball and Bruce Golden; Amount: $42,000.
7/84-6/87	IBM Corporation; "Interactive Network Optimization, Routing and Scheduling", part of project FULCRUM (Facilities for Understanding Learning and Creative Research at the University of Maryland); co-principal investigators: Michael Ball and Lawrence Bodin; equipment grant.
10/80-4/84	Urban Mass Transportation Administration of U.S Department of Transportation; "Development of a Generalized Matching Code for Mass Transit System Planning"; co-principal investigators: Michael Ball and Lawrence Bodin; Amount: $199,000.

AWARDS AND HONORS

Systems Engineering Faculty Member of the Year (1996), Institute for Systems Research, University of Maryland.

Supervised thesis of Robert Hoffman, which was awarded Honorable Mention (2nd Place) in the INFORMS Transportation Science Dissertation Prize Competition (1997).

"Advanced Available-to-Promise" project funded by, and jointly carried out with, Toshiba Corporation received "the Outstanding Contribution to Business Performance Award" from the Director of Toshiba Corporate Manufacturing Engineering Center (CMC), June, 2003.

Best Paper in Traffic Flow Optimization at the 5th USA/Europe ATM 2003 R&D Seminar (paper co-authored with T. Vossen, R. Hoffman and M. Wambsganss).

Supervised thesis of Thomas Vossen, which was awarded first place in the INFORMS Transportation Science Dissertation Prize Competition (2003) and honorable mention in the INFORMS Aviation Applications Section Dissertation Prize Competition (2003).

Named INFORMS Fellow, October, 2004.

Best Paper in Traffic Flow Optimization at the 6th USA/Europe ATM 2005 R&D Seminar (paper co-authored with D. Lovell, R. Hoffman and A. Mukherjee).

Best Paper in Metrics and Performance Management at the 6th USA/Europe ATM 2005 R&D Seminar (paper co-authored with D. Lovell, A. Mukherjee, A. Odoni and G. Zerbib).

Honorable Mention, INFORMS 2006 Transportation Science Best Paper Award (paper co-authored with T. Vossen)

Best Paper in Finance and Policy at the 9th USA/Europe ATM 2011 R&D Seminar (paper co-authored with A. Churchill, A.D. Donaldson and R.J. Hansman).

Best Paper in Advanced Modeling at the 2012 5th International Conference on Research in Air Transportation (paper co-authored with Rong Wong and David Lovell)

Honorable mention in 2012 INFORMS Section on Public Programs, Services and Needs (SPPSN) Best Paper Competition (paper co-authored with P. Swaroop).

Best Paper in Network Management Track at the 2014 6th International Conference on Research in Air Transportation (paper co-authored with James Jones and David Lovell)

Best Paper in the Performance Measurement and Management Track at the 12th USA/Europe 2017 ATM R&D Seminar (paper co-authored with Alex Estes and David Lovell).

Best paper in the Trajectory Optimization Track at the 2018 8th International Conference on Research in Air Transportation (paper co-authored with Alex Estes and David Lovell)

Best paper in the Network Management Track at the 2018 8th International Conference on Research in Air Transportation (paper co-authored with Alex Estes and David Lovell)

EDITORIAL ACTIVITIES

Associate Editor: *Networks (82-06); IEEE Transactions on Reliability (87-93); Operations Research Letters (91-98); Operations Research (00-pres); IIE Transactions (01-05); Naval Research Logistics (03 – 05), Transportation Science (03-pres).*

Area Editor: *Operations Research-Transportation (1/2006-12/2011); Operations Research-Optimization* (7/1992-12-1995):

Editor   Special Issue of *Transportation Science*, "Aviation Operations Research: Commemorating 100 Years of Aviation", 2003.

Special Issue of *Networks*, "The Matching Problem: Theory, Algorithms and Applications", 1983 (co-editor, U. Derigs).

Referee: *Operations Research, Management Science, Mathematical Programming, Operations Research Letters, Networks, Mathematics of Operations Research, SIAM Journal on Applied Mathematics, SIAM Journal on Algebraic and Discrete Methods, SIAM Journal on Computing, IEEE Transactions on*

Reliability, IEEE Transactions on Circuits and Systems, Decision Sciences, Zeitschrift fur Operations Research.

Reviewer: National Science Foundation, Natural Science and Engineering Research Council of Canada, Office of Naval Research, Army Research Office, Air Force Office of Scientific Research.

PROFESSIONAL MEMBERSHIPS

Institute for Operations Research and the Management Sciences (INFORMS) and formerly Operations Research Society of America: Workshop Committee (member 1986-1990, chairman 1987-1990); Lanchester Prize Committee (member 1990-1991, chairman 1991); INFORMS Impact Prize (member 2004); Transportation Science and Logistics Society (member 1981-pres; Vice President 2007; President 2008); Special Interest Group on Computer Science (member 1981-1994); Special Interest Group on Telecommunications (member 1988-pres); Distinguished Lectureship Committee (member 1983-1984); Education Committee (member 1983-1985); member Optimization Society Khacian Award Committee (2015).

Former member of: *Mathematical Programming Society. Society for Industrial and Applied Mathematics,   IEEE, Air Traffic Control Association.*

CONFERENCE ORGANIZING

Organizer and Co-Host: NEXTOR-III Webinar Series: The Pandemic and Aviation: What has happened? What have we learned? How do we go forward?, July-November 2020.

Member of the Program Committee: 9th *International Conference on Air Transportation Research*, June 2020.

Member of the Program Committee: 13th *USA/Europe Air Traffic Management R&D Seminar*, Vienna, June, 2019

Member of the International Scientific Committee, *Triennial Symposium on Transportation Analysis (TRISTAN 10)*, Hamilton Island, Australia, June, 2019.

Member of the Program Committee: 8th *International Conference on Air Transportation Research*, Castelldelfels, Spain, June 2018.

Member of the Program Committee: 12th *USA/Europe Air Traffic Management R&D Seminar*, Seattle, June, 2017

Member of the Organizing Committee, INFORMS Transportation and Logistics Society First Triennial Conference, Chicago, July, 2017.

Chair of Organizing Committee, NEXTOR 20th Anniversary Workshop, University of Maryland, College Park, MD, September, 2016.

Member of the International Scientific Committee, *Triennial Symposium on Transportation Analysis (TRISTAN 9), Aruba*, June, 2016.

Co-Chair, Global Challenges to Improve Air Navigation Performance, FAA-NEXTOR Workshop, Asilomar Conference Grounds, Pacific Grove, CA, February, 2015.

Member of the Scientific Committee: 4th INFORMS Transportation Science and Logistics Workshop, Berlin, July, 2015.

Member of the Program Committee: 11th *USA/Europe Air Traffic Management R&D Seminar*, Lisbon, June, 2015.

Member of the Program Committee: *6th International Conference on Research in Air Transportation,* Istanbul, 2014.

Member of the Program Committee: 10th *USA/Europe Air Traffic Management R&D Seminar*, Chicago, June, 2013.

Member of the International Scientific Committee *Triennial Symposium on Transportation Analysis (TRISTAN 8),* San Pedro de Atacama, Chile, June, 2013.

Co-organizer (with M. Florian and T. Lawphongpanich), *Congestion Management of Transportation Systems on the Ground and in the Air,* Inaugural INFORMS Transportation Science and Logistics Society Workshop, Asilomar Conference Grounds, Pacific Grove, CA, June 2011.

Member of the Program Committee: 9th *USA/Europe Air Traffic Management R&D Seminar*, Berlin, June, 2011.

Member of the International Scientific Committee: *Triennial Symposium on Transportation Analysis (TRISTAN 7),* Tromso, Norway, June, 2010.

Member of the Program Committee: *8th USA/Europe Air Traffic Management R&D Seminar*, Napa, CA, June, 2009.

Program Co-Chair (with G. Anandalingam*) INFORMS National Meeting*, Washington, DC, Fall, 2008.

Co-organizer (with M. Savelsbergh) *Symposium in Honor of Seventieth Birthday of George Nemhauser*, Atlanta, July, 2006.
Co-organizer (with K. Hoffman and M. Hansen) *Allocation and Exchange of Airport Access Rights.* workshop sponsored by the FAA, Aspen Institute, Wye River, Maryland, June 2007.

Co-organizer (with G. Donohue and K. Hoffman) *Workshop on Government, the Airline Industry and the Flying Public: a New Way of Doing Business,* workshop sponsored by the FAA, Aspen Institute, Wye River, Maryland, June, 2004.

Member of the International Scientific Committee: *Triennial Symposium on Transportation Analysis (TRISTAN 5),* Guadeloupe, June, 2004.

Member of the Program Committee: *EURO/INFORMS Joint International Meeting,* Istanbul, July, 2003.

Co-organizer (with G. Donohue and K. Hoffman) *Workshop on National Airspace System Resource Allocation: Economics and Equity*, workshop sponsored by the FAA, Aspen Institute, Wye River, Maryland, March, 2002.

Member of the Advisory Committee: *Triennial Symposium on Transportation Analysis (TRISTAN 4),* Azores, June, 2001.

Co-organizer (with A. Odoni): *Workshop on Airline and National Strategies for Dealing with Airport and Airspace Congestion*, College Park, MD, March, 2001.

Member of the Program Committee, *First International Conference on Telecommunications and Electronic Commerce (ICTEC*), November, 1998.

Member of Organizing and Program Committee: *1998 International Meeting of INFORMS*, Tel Aviv, June, 1998.

Member of the Advisory Committee: *Triennial Symposium on Transportation Analysis (TRISTAN 3),* Puerto Rico, June, 1998.

Member of the Advisory Committee: *Symposium on Combinatorial Optimization*, London, March, 1996.

Member of the Advisory Committee: *Triennial Symposium on Transportation Analysis (TRISTAN 2),* Capri, June, 1994.

Member of the Advisory Committee*: Triennial Symposium on Transportation Analysis (TRISTAN 1),* Montreal, July, 1991.

Member of the Organizing Committee: *Fifth International Workshop on Computer Aided Planning in Public Transport*, Montreal, August, 1990.

Member of the Organizing Committee: *Fourth International Workshop on Computer Aided Planning in Public Transport*, Hamburg, West Germany, July, 1987.

Member of the Organizing Committee: *Interdisciplinary Workshop on Network Reliability*, Stevens Institute of Technology, August, 1983.

Co-Organizer with L. Bodin and K. Hoffman: *Symposium on the Matching Problem: Theory, Algorithms and Applications*, National Bureau of Standards, October, 1981.

Co-Organizer with L. Bodin, B. Golden and S. Gass, *Workshop to Investigate Future Directions in Routing and Scheduling of Vehicles and Crews*, University of Maryland, College Park, June, 1979.

Track Chairman: "Network Scheduling and Routing", *ORSA/TIMS Joint National Meeting*, Miami, October, 1986.

PRESENTATIONS

Over 150 presentations delivered at national and international meetings.

Over 50 seminars delivered at universities in the United States, Canada and Europe.

Collaborative Decision Making in Air Traffic Management, Tutorial, *8th International Conference on Air Transportation Research*, Castelldelfels, Spain, June 2018.

"Improving Air Transportation System Performance through Coordinated Speed Control", ***Keynote Address***, Global Workshop on Aviation System Performance, Tianjin, China, July 2016.

"Air Transportation Operations Research: a Bit of History and Recent Trends", **Keynote Address** at the Annual Meeting of Operations Research Society – Israel (ORSIS), June 2016.

"Model Decomposition and Integration: Case Studies from Urban Transit and Airline Planning Problems", ***Plenary Address***, 4th INFORMS Transportation Science and Logistics Workshop, July 2015.

"Collaborative Decision Making in Air Traffic Management", ***Plenary Address***, *Triennial Symposium on Transportation Analysis (TRISTAN 8),* San Pedro de Atacama, Chile, June, 2013.

"Recent Airport Congestion Management Initiatives in the United States", ***Keynote Address***, SPADE-2 World-Wide Conference, Las Palmas de Gran Canaria, Spain, November, 2009.

"How to Eliminate Air Transportation Delays", ***Keynote Address***, INFORMS Manufacturing and Service Operations Management Annual Meeting, University of Maryland, College Park, MD, June, 2008.

"How to Fix a Broken Timetable: Collaborative Mechanisms for Managing Airport Capacity Reductions in the U.S.", ***Keynote Address***, The 7th International Conference on the Practice and Theory of Automated Timetabling, Montreal, August, 2008.

"Optimization Based Tradeoff Analysis", ***Invited Semi-plenary Lecture*** delivered to *the Annual Conference of DGOR and GMOOR* (the two German Operations Research Societies), Braunsweig, Germany, September, 1996

"Using GIS to Support Route Planning and Facility Location", Invited Lecture delivered in the *Symposium on Managing the Supply Chain* (part of *The Northwestern University Manufacturing Management Symposium Series*) Evanston, IL, May, 1996

"Design and Analysis of Reliable Networks", delivered as a major address at three different meetings:
-- plenary address: Optimization Days, Montreal, May, 1993.
-- semi-plenary address: Joint Meeting of DGOR and SVOR (2 German OR societies), September, 1993.
-- tutorial, ORSA/TIMS Joint National Meeting, Phoenix, November, 1993.

"Using Geographic Information Systems as a Platform for Operations Research", all day workshop presented at the ORSA/TIMS Joint National Meeting, San Francisco, November, 1992, joint with L. Bodin, G. Fagan and E. Ziering.

"Vehicle Routing and Scheduling with Special Emphasis on Commercial Vehicle Routing Systems for Microcomputers", all day workshop presented at the ORSA/TIMS Joint National Meeting, Atlanta, November, 1985, with A. Assad, L. Bodin and B. Golden.

"The Routing and Scheduling of Vehicles and Crews", all day workshop presented at the ORSA/TIMS Joint National Meeting, Orlando, November, 1983, joint with A. Assad, L. Bodin and B. Golden.

COURSES TAUGHT

University of Maryland:
        Advanced Networks and Combinatorics
        Decision Analysis and Modeling
        Distributed Data Processing
        Economics of Information Systems
        Integer Programming
        Introduction to Database Systems
        Introduction to Management Science
        Introduction to Optimization
        Management Information Systems
        Management of Telecommunications Networks
        Pricing and Revenue Management
        Security and Control of Information Systems
        Seminar on Computational Complexity
        Supply Chain Modeling and Analysis

Ranked in top 15% of undergraduate instructors in College of Business and Management -- Fall 1982.

Ranked in top 15% of MBA instructors in College of Business and Management -- Spring 1983, Fall 1986, Spring 1988.

University of Waterloo:
        Combinatorial Computing

Seminar on Routing and Scheduling

University of North Carolina:
Theory of Reliability

University of California, Berkeley:
Systems Analysis for Civil Engineers
Systems Analysis in Transportation

PERSONAL

US Citizen; married, three children, born July 20, 1950 in Washington, DC.

THESES SUPERVISED

A. Roberts, "A Graph Partitioning Approach to Air Crew Scheduling", MS – Business & Management, U. of Maryland, December, 1983.

R. Taverna, "Solving Matching Problems with a Single Generalized Upper Bound Side Constraint", MS – Business & Management, U. of Maryland, May, 1984.

S. Cherng, "Solving the Single Depot Vehicle Scheduling Problem in a Micro-Computer Environment", MA – Applied Mathematics, U. of Maryland, May, 1984.

M. Max, "A Micro-Computer Based Decision Support System for Capital Budgeting", MS – Business & Management , U. of Maryland, December, 1986.

E. Cameron, "Efficient Implementation of Network Reliability Analysis Algorithms", MAS – Management Science, U. of Waterloo, June, 1986.

H. Benoit, "A Lagrangian Relaxation Based Heuristic for the Urban Transit Crew Scheduling Problem", MAS – Management Science, U. of Waterloo, June, 1986.

V. Jeffs, "Availability and Cost Evaluation System for Micro-Computers", MS – Business & Management, U. of Maryland, May, 1987.

J. Greenberg, "Dual Ascent Using Valid Inequalities for the Directed Steiner Tree Problem", MS – Business & Management, U. of Maryland, May, 1988.

F. Lin, "Reliability Constrained Integer Programming Models with Applications to Facility Location", PhD – Business & Management, U. of Maryland, May, 1992.

S. Su, "The General Postman Problem -- Models and Algorithms", PhD – Business & Management, U. of Maryland, August, 1992.

H. Gun, "Polyhedral Structure and Efficient Algorithms for Certain Classes of the Directed Rural Postman Problem", PhD – Applied Mathematics, U. of Maryland, December, 1993.

A. Datta, "Database Environments for Decision Support and Control Systems", PhD – Business & Management , U. of Maryland, May, 1994.

A. Vakhutinsky, "Fault Tolerant Rerouting in Broadband Multiclass Networks", PhD – Business & Management , U. of Maryland, December, 1996.

R. Hoffman, "Integer Programming Models for Ground Holding in Air Traffic Flow Management", PhD – Applied Mathematics, U. of Maryland, December, 1997.

J. Splain, , "A User Interface For Discrete Optimization-Based Tradeoff Analysis", MSSE – Systems Engineering, U. of Maryland, May, 1998

T. Butler, "Optimization Model with Fairness Objective for Air Traffic Management", MA – Applied Mathematics, U. of Maryland, August, 1998.

V. Trichur, "Integer Programming Models for Product Design", PhD – Business & Management, U. of Maryland, December, 1999.

T. Inniss, "Stochastic Models for Determining Airport Arrival Capacity Distributions", PhD – Applied Mathematics, U. of Maryland, December, 2000.

N. Bhogadi, "Modeling Demand Uncertainties during Ground Delay Programs", MSSE – Systems Engineering, U. of Maryland, August, 2002.

J. Burke, "Implementing and Evaluating Alternate Airspace Rationing Methods", MSSE – Systems Engineering, U. of Maryland, August, 2002.

B. Chandran, "Predicting Airspace Congestion Using Approximate Queueing Models", MS – Business & Management, U. of Maryland, August, 2002.

T. Vossen, "Fair Allocation Methods in Air Traffic Management", PhD – Business & Management, U. of Maryland, December, 2002.

C-Y Chen, "Optimization Based Available to Promise", PhD – Business & Management, U of Maryland, December, 2003

J. McNeil, "Order Assignment and Resource Reservation: an Optimization Model and Policy Analysis", MSSE – Systems Engineering, U. of Maryland, May, 2005

F. Faber, "An Extensible Order Promising and Revenue Management Testbed", MSSE – Systems Engineering, U of Maryland, May, 2005

M. Chen, "Coordinating Demand Fulfillment with Supply across a Dynamic Supply Chain", PhD – Business & Management, May, 2006.

Y. Tu, "Air Transportation System Performance: Estimation and Comparative Analysis of Departure Delays", PhD – Business & Management, U of Maryland, December, 2006.

B. Subramanian, "Aggregate Statistical Models for National Airspace System Performance", MSSE – Systems Engineering, August, 2007.

H. Gao, "Analysis of Distribution Free Methods for Revenue Management", PhD -- Business & Management, U of Maryland, December, 2008 (co-advisor, I. Karaesmen).

Y. Lan, "Robust Revenue Management with Limited Information: Theory and Experiments", PhD – Business & Management, U of Maryland, August, 2009 (co-advisor, I. Karaesmen).

N. Vakili, "Preference-Based Fair Allocation of Limited Airspace Resources", PhD – Electrical Engineering, U of Maryland, December, 2009, (co-advisor, S. Marcus).

C. Glover, "Computationally Tractable Integer Programming Models for Air Traffic Flow Management", PhD – Applied Mathematics, August, 2010.

P. Swaroop, "Problems and Models in Strategic Air Traffic Flow Management", PhD – Business & Management, U of Maryland, August, 2013.

A. Estes, "Problems Originating from the Planning of Air Traffic Management Initiatives", PhD – Applied Mathematics and Scientific Computation, August, 2018.

BOOKS

Ball, M., Magnanti, T., Monma, C. and Nemhauser, G., eds, 1995, *Handbook of Operations Research and Management Science: Network Models*, Elsevier, Amsterdam.

Ball, M., Magnanti, T., Monma, C. and Nemhauser, G., eds, 1995, *Handbook of Operations Research and Management Science: Network Routing*, Elsevier, Amsterdam.

PAPERS IN REFEREED JOURNALS

Ball, M. O., R. Van Slyke, I. Gitman and H. Frank, 1976, "Reliability of Packet Switching Broadcast Radio Networks", *IEEE Transactions on Circuits and Systems*, **CAS-23**, 806-813.

Ball, M. O. and R. Van Slyke, 1977, "Backtracking Algorithms for Network Reliability Analysis", *Annals of Discrete Mathematics I: Studies in Integer Programming,* P. L. Hammer and E. L. Johnson, B. H. Korte and G. L. Nemhauser, eds., (North Holland, New York), pp. 49-64.

Ball, M. O., W. Bialas and D. Loucks, 1978, "Planning the Location and Capacity of Flood Control Structures", *Water Resources Research*, **14**, 62-66.

Golden, B. and M. O. Ball, 1978, "Shortest Paths with Euclidean Distances: An Explanatory Model", *Networks*, **8**, 297-314.

Ball, M. O., 1979, "Computing Network Reliability", *Operations Research*, **27**, 823-838.

Ball, M. O. and G. L. Nemhauser, 1979, "Matroids and a Reliability Analysis Problem", *Mathematics of Operations Research*, **4**, 132-143.

Ball, M. O., 1979, "The Complexity of Network Reliability Computations", *Networks*, **10**, 153-165, reprinted in *The World of Large Scale Systems*, J. Palmer and R. Saeks eds., IEEE Press, John Wiley, New York, 1982, pp 185-190.

Ball, M. O. and M. Magazine, 1981, "The Design and Analysis of Heuristics", *Networks*, **11**, 215-219.

Golden, B., M. O. Ball and L. Bodin, 1981, "Current and Future Research Directions in Network Optimization", *Computers and Operations Research*, **8**, 71-81.

Ball, M. O. and J. S. Provan, 1981, "Bounds on the Reliability Polynomial for Shellable Independence Systems," *SIAM Journal on Algebraic and Discrete Methods*, **3**, 166-181.

Ball, M. O., L. Bodin and R. Dial, 1983, "A Matching Based Heuristic for Scheduling Mass Transit Crews and Vehicles", *Transportation Science*, **17**, 4-31.

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