

## **Operations Research Center**

The Operations Research Center (ORC), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 51st year of operation in 2003–2004. The ORC administers its own graduate programs and a varied research program of methodological and applied projects. It maintains a reading room with a small library, as well as state-of-the art computational workstations.

This report summarizes the center's 2003–2004 activities and briefly reviews its educational, research, and outreach programs.

### **Faculty, Students, Staff**

Professors James B. Orlin, Edward Pennell Brooks professor of operations research, and John N. Tsitsiklis, professor of electrical engineering and computer science, served as codirectors during 2003–2004.

This year the ORC had 47 affiliated faculty and senior staff, with faculty drawn from the Sloan School of Management and the Departments of Electrical Engineering and Computer Science, Civil and Environmental Engineering, Ocean Engineering, Mathematics, Aeronautics and Astronautics, Mechanical Engineering, Nuclear Engineering, and Urban Studies and Planning. Three faculty members joined the ORC this year: Olivier L. de Weck (Aeronautics and Astronautics), Daniela Pucci de Farias (Mechanical Engineering), and Asuman Ozdaglar (EECS). The last two are women, bringing the number of female ORC-affiliated faculty to four.

The ORC offers two interdepartmental graduate degree programs, leading to a PhD and a master's degree, respectively. During 2003–2004, these programs enrolled 50 students—41 PhD candidates and nine SM candidates. The center conferred nine master's degrees and eight PhDs. Several other PhD theses were in the final stages of completion in the summer of 2004.

### **Academic Programs**

The ORC's academic programs continue to be recognized as ranking among the very best nationally and internationally. The program, moreover, is repeatedly cited for achieving an excellent balance between application and methodological domains.

### **Research Activities**

Research activities spanned a wide spectrum of methodological topics and applications, ranging from small, unsponsored projects involving a single faculty member supervising a student's thesis, to much larger sponsored programs involving several faculty/staff and students.

Methodological research includes such topics as linear, nonlinear, and combinatorial optimization; solution methods for integer programming; interior point methods for linear and nonlinear programming; dynamic programming; cluster analysis; parallel

and distributed computation and algorithms; network flow algorithms; network design; probabilistic combinatorial optimization; deterministic and stochastic facility location; queueing theory, including queueing networks; risk analysis and stochastic processes; classical and Bayesian statistics; game theory; and decision analysis and statistical decision theory.

ORC faculty are also currently contributing to application domains as wide ranging as manufacturing, communications, transportation, public services, logistics, marketing, financial services, health care, and nuclear engineering. Current projects are addressing topics such as air traffic control, epidemiology, AIDS testing, life-cycle modeling of municipal solid waste, safety and risk analysis in air transportation, telecommunication network design, supply chain management, production scheduling, and transportation logistics.

Several organizations sponsored research projects at the ORC during 2003–2004, including the National Science Foundation, C. S. Draper Laboratory (several projects as well as Draper Fellowships), General Motors, the Federal Aviation Administration's Center of Excellence for Aviation Operations Research, Logistics Management Institute, Office of Naval Research, and the Singapore-MIT Alliance.

### **Outreach and Professional Service**

In its effort to serve the professional community at large, the ORC regularly undertakes a number of outreach activities, topped this year by a very special event.

In April 2004, the center celebrated its 50th anniversary as an MIT interdepartmental program. The celebration began on Saturday, April 24, with a full day of presentations by ORC alumni and faculty, representing each of the five decades during which the ORC has operated. The center will eventually develop a book from the transcripts of these talks. Following the all-day presentations were a reception and dinner. On Sunday, April 25, the ORC and INFORMS held a joint symposium, marking the first day of the INFORMS Practice meeting, held this year in Boston. The ORC's 50th anniversary brought together more than 270 of the center's alumni, current faculty, and students.

Additional information on ORC's 50th Anniversary Celebration can be viewed in *OR/MS Today* at <http://lionhrtpub.com/orms/orms-2-04/frmit.html>.

The ORC cohosted the 4th Annual INFORMS Revenue Management and Pricing Section Conference. The event, co-organized by Professor Georgia Perakis, featured presentations from a mix of academic and industry leaders in the field of revenue management and pricing.

During the year, the ORC also instituted a Tuesday seminar series for its students to complement the Thursday seminar series. The Tuesday seminar series combines internal research presentations with professional development seminars.

Professors Amedeo R. Odoni and Richard de Neufville offered a professional course in October 2003: "Airport Systems: Planning, Design, and Management."

The ORC Seminar Series was privileged to feature many distinguished speakers from industry and academia this year. Among the many operations research professionals who made presentations were Christos Cassandras (Boston University), Sheldon Ross (UC Berkeley), Thanasis Ziliaskopoulos (Northwestern), Garrett van Ryzin (Columbia), Claire Kenyon (École Polytech), Michael Rothkopf (Rutgers), Clifford Stein (Columbia), Vasant Shar (NYU), Ozlem Ergun (Georgia Tech), Gerard Chaon (U Penn), Ben Van Roy (Stanford), Moshe Dror (MIT), Arkadi Nemirovski (Technion), Bill Cunningham (University of Waterloo), Paul Zipkin (Duke), and Jay Sethuraman (Columbia).

The center also offered a program of activities during the January Independent Activities Period, including a series of presentations on the practice of operations research and management science by Mitchell H. Burman and Timothy S. Kniker (Analytics Operations Engineering), Richard C. Larson (MIT), Andrew Lo (MIT); Arnie Barnett (MIT), Warren Powell (Princeton), and C. S. Venkatakrishnan (J. P. Morgan Investments).

### **Operational Issues**

During 2003–2004, the Operations Research Center did not experience any significant operational or organizational challenges.

During the past year, the center published the ORC Working Paper Series electronically in DSpace at MIT. DSpace is “a newly developed digital repository created to capture, distribute and preserve the intellectual output of MIT.” All of the working papers are accessible for downloading via the web.

During the spring term, a number of ORC faculty members participated in an ORC-ESD committee, chaired by Professor Richard C. Larson, to explore venues for interaction between the ORC and the Engineering Systems Division. Some of the possibilities identified were joint seminars, joint research initiatives, and contributing to the development of a quantitative core for ESD doctoral students. In addition, several ORC faculty members were actively involved in the search to fill a dual EECS-ESD position.

### **Future Plans**

There are no plans for substantial changes in the direction and operation of the Operations Research Center. A short-term challenge relates to the conclusion of SMA-I that used to fund a sizable number of ORC students. The ORC is exploring possibilities for block-funding, so as to maintain its ability to admit and recruit top student candidates.

### **Diversity**

The ORC has always attempted to provide an environment that is responsive to the varied professional and personal needs of the operations research community at MIT, and that builds upon diversity.

The ORC makes no faculty appointments. The staff of the center consists of two support staff and one administrative officer. Of these three, all are women, and two are African American.

### Professional Activities

- Arnold I. Barnett was named an INFORMS Fellow, October 2003.
- Cynthia Barnhart, Andrew Armacost, and K. A. Ware received the TSL Best Paper Award for their paper “Composite Variable Formulations for Express Shipment Service Network Design,” October 20, 2003. This award is given by the INFORMS Transportation Science and Logistics Section.
- John Paul Clarke received the FAA’s prestigious Excellence in Aviation Award, December 2003.
- John Hauser, Olivier Toubia, Duncan Simester, and Ely Dahan’s paper “Fast Polyhedral Adaptive Conjoint Estimation,” published in *Marketing Science* 22:3, was selected as a finalist for the John D. C. Little Best Paper Award of the INFORMS Society of Marketing Science.
- Richard C. Larson was elected president-elect of INFORMS. Dick will be the third MIT/ORC faculty member to serve as INFORMS president since INFORMS was created in the merger of ORSA and TIMS in 1995. The first INFORMS president was John D. C. Little, who served in 1995. Tom Magnanti served as president in 1999. Larson also received the INFORMS President Award for his contributions to the welfare of society, and was the recipient of the Harold Larnder Prize, awarded annually to an individual who has achieved international distinction in operational research. The prize winner delivers the Harold Larnder Memorial Lecture at the National Conference of the Canadian Operational Research Society.
- John Little was elected to the IFORS Operational Research Hall of Fame. The announcement was made during the ORC’s 50th Anniversary Celebration held on April 24, 2004. His paper “Models and Managers: The Concept of a Decision Calculus” was selected as one of the Top Ten Most Influential Papers in Management Science by the INFORMS membership for the 50th anniversary of *Management Science*, April 29, 2004.
- Thomas L. Magnanti was recently chosen to be the next president of IFORS. IFORS is an international organization of 44 national societies of operations research (including INFORMS) together with five kindred member societies.
- Asuman Ozdaglar was the recipient of a GSC Graduate Teaching Award from the MIT School of Engineering, May 2004.
- Daniela Pucci de Farias received the Esther and Harold Edgerton faculty development chair.
- Amr Farahat, an ORC student, received a UPS Fellowship for 2003–2004.

- Victor Martinez de Albeniz, an ORC student, received honorable mention in the 2003 George Nicholson Student Paper Competition held by INFORMS. He was also a 2003 finalist in the MSOM Student Paper Competition.
- Amy Cohn (PhD, 2002) received honorable mention for her PhD dissertation from the INFORMS Section on Aviation Applications.
- Sanne de Boer (PhD, 2003) received honorable mention for his PhD dissertation from the INFORMS Section on Aviation Application. He also won second place in the George Nicholson Student Paper Competition held by INFORMS.
- Bruce L. Golden (PhD, 1976) received the INFORMS Prize for the Teaching of OR/MS Practice.
- Edward H. Kaplan (PhD, 1999), David L. Craft (ORC PhD student), and Lawrence M. Wein were awarded the Koopman Prize from the INFORMS Military Applications Society for their paper “Emergency Response to a Smallpox Attack: The Case for Mass Vaccination.”
- Edward Kaplan (PhD, 1984) was elected a member of the National Academy of Engineering. Ed was honored “for assessment of needle-exchange programs and for generally bringing engineering perspectives to the design of public health policies.”
- Ioana Popescu (PhD, 1999) won first prize in the JFIG (Junior Faculty Interest Group) paper competition.

**James B. Orlin, Codirector and Edward Pennell Brooks Professor of Operations Research**  
**John N. Tsitsiklis, Codirector and Professor of Electrical Engineering and Computer Science**

*More information about the Operations Research Center can be found online at <http://web.mit.edu/orc/www>.*