

Engineering Systems Division

Now a little over a decade old, the [Engineering Systems Division](#) (ESD) encompasses bold, forward-thinking educational and research efforts aimed at tackling real-world challenges. Using new framing and modeling methodologies, ESD research integrates approaches from engineering, management, and social sciences. A truly interdisciplinary academic unit, ESD spans most departments within the School of Engineering as well as the School of Humanities, Arts, and Social Sciences; the Sloan School of Management; the School of Science; and the School of Architecture and Planning.

ESD brings together students and faculty interested in research that focuses on complex systems involving technology, organizations, and individuals. ESD focuses primarily on four key domains: extended enterprises, energy and sustainability, critical infrastructure, and health care delivery. ESD recognizes that the major challenges in these areas do not have purely technical solutions, but require more holistic analysis and interdisciplinary approaches. ESD's research approaches often focus on the areas of people and technology, uncertainty and dynamics, design and implementation, networks and flows, and policy and standards. To ensure that the approaches and solutions developed by ESD are relevant, faculty and students have forged novel relationships with partners in industry, government, and academia.

Approximately 60 faculty members, most holding dual or joint appointments within ESD and one of the aforementioned units, are devoted to teaching and research in the field of engineering systems. As of spring 2010, 365 students were enrolled in ESD's five master's programs, with another 52 students in the PhD program.

ESD's values, mission, and vision are outlined in its [2008 strategic report](#).

Faculty

The ESD director is Yossi Sheffi, Elisha Gray II professor of engineering systems and professor of civil and environmental engineering. Olivier de Weck, associate professor of aeronautics and astronautics and engineering systems, is ESD associate director. Nancy Leveson, professor of aeronautics and astronautics and engineering systems, oversees ESD's PhD program, including admissions. She also chaired the ESD Education Policy Committee.

After an extensive faculty search, ESD welcomed two new junior faculty members in 2010: Jessika Trancik, assistant professor of engineering systems, and Noelle Eckley Selin, assistant professor of engineering systems and atmospheric chemistry. Trancik was a postdoctoral fellow at the Santa Fe Institute and an adjunct associate research scholar at Columbia University's Earth Institute. Her research focuses on the evolution of technologies and on decomposing performance trajectories of energy systems. She is particularly interested in understanding the dynamics and limits of costs and carbon intensities of energy technologies in order to inform climate change mitigation efforts. Selin was previously a research scientist with the Center for Global Change Science and the Joint Program on the Science and Policy of Global Change at MIT. Her research and

teaching focus on using atmospheric chemistry modeling and other analyses to inform decision-making strategies on air pollution, climate change, and hazardous substance management.

ESD welcomed four new joint faculty members: John Fernandez, associate professor, building technology and engineering systems; Marta González, assistant professor of civil and environmental engineering and engineering systems; Donald Lessard, professor of global economics and management and professor of engineering systems; and Anthony Sinskey, professor of biology and health sciences and technology and professor of engineering systems.

Research Staff

Qi Van Eikema Hommes joined ESD as a research associate. She is interested in developing methods and tools that improve the design and development of large complex engineering systems and products. Before coming to MIT, Van Eikema Hommes was a senior research scientist with the General Motors Research and Development Division.

Anas Alfaris joined ESD as a research scientist. His present work focuses on developing computational design systems for the design of complex engineering systems.

Afreen Siddiqi joined ESD as a research scientist. Her present work focuses on determining requirements for sustainability for future carbon-neutral urban systems (as part of an MIT–Masdar Institute of Science and Technology collaborative research initiative) and on managing engineering change (in collaboration with BP).

Graduate Education

The [ESD PhD program](#) continues to grow and thrive, admitting 14 of 93 applicants for the 2010 academic year (with 12 students matriculating in September 2009). Applications for the upcoming year remained strong, with approximately 90 students applying to begin the program in AY2011. ESD awarded 10 doctoral degrees in AY2010 and 178 degrees overall. In addition to the engineering systems PhD and SM, master's-level programs include [Leaders for Global Operations \(LGO\)](#), the [MIT Supply Chain Management Program](#), the Master of Engineering in Logistics (MLOG) degree, the [System Design and Management \(SDM\) Program](#), and the [Technology and Policy Program \(TPP\)](#). More details about these five master's programs are provided in this report.

Undergraduate Education

ESD is currently exploring how it might respond to an increased desire among undergraduates for more flexibility in their academic programs and an increased interest in real-world system problems by providing an undergraduate offering in engineering systems. Also, a number of ESD faculty are involved in developing the new Singapore University of Technology and Design, which has engineering systems (for undergraduates) as one of its major academic pillars.

ESD continues to have some involvement with MIT undergraduates via the [Bernard M. Gordon–MIT Engineering Leadership Program](#), directed by Edward Crawley, professor of aeronautics and astronautics and engineering systems and Ford professor of engineering. The program, housed in the School of Engineering, provides selected undergraduates with a set of leadership-oriented, discipline-building, hands-on engineering activities set in the context of the practice of engineering. [The program graduated its first class of students in May 2010.](#)

Research

ESD continues to encompass several major research centers, including the Center for Engineering Systems Fundamentals (CESF); the Center for Technology, Policy, and Industrial Development (CTPID); and the Center for Transportation and Logistics (CTL). The Center for Biomedical Innovation (CBI) joined ESD in 2009 and continues to tackle large-scale challenges in the health care industry. These research programs are described later in this report.

Professor Fred Moavenzadeh is director of the MIT Technology and Development Program. Along with David Marks, Morton and Claire Goulder Family professor of civil and environmental engineering and engineering systems, he is on executive committees for the Abu Dhabi Cooperative Program and the Masdar Institute of Science and Technology. Moavenzadeh was recently named president of the Masdar Institute.

The MIT–Portugal Program, launched in October 2006, is a strategic investment in people, knowledge, and ideas by the Portuguese government to strengthen the country’s knowledge base and international competitiveness. This transatlantic collaboration involves MIT and government, academia, and industry in Portugal in the development of education and research programs in engineering systems. MIT–Portugal is hosted by ESD and is led at the Institute by ESD’s founding director, professor Daniel Roos, who serves as MIT director of the program. See the MIT–Portugal Program report to the president for further information.

Personnel Achievements

ESD Faculty Highlights

George Apostolakis was named commissioner of the US Nuclear Regulatory Commission on April 23, 2010, to a term ending on June 30, 2014.

Cynthia Barnhart was elected to the National Academy of Engineering ([MIT Tech](#), February 19, 2010). Barnhart is professor of [civil and environmental engineering](#) and engineering systems, codirector of the [Operations Research Center](#), and associate dean for academic affairs, [MIT School of Engineering](#).

Joseph Coughlin, ESD senior lecturer and director of the AgeLab and New England University Transportation Center, was named a fellow of the Gerontological Society of America, the largest scientific interdisciplinary organization devoted to research, education, and practice in the field of aging.

Olivier de Weck was appointed to a National Research Council committee. He received the Capers and Marion McDonald Award for Excellence in Mentoring and Advising.

Nancy Leveson gave a plenary address on “Electronic Health Records: Unintended and Unanticipated Consequences” at the AMIA 2009 Health Policy meeting. Also, Professor Leveson’s 1995 book titled *Safeware: System Safety and Computers* was published in Japanese.

Professor David Mindell won the 2008 Eugene E. Emme Award for Astronautical Literature, granted by the American Astronautical Society, for his book *Digital Apollo—Human and Machine in Spaceflight* (MIT Press, 2008).

Fred Moavenzadeh was appointed president of the Masdar Institute of Science and Technology.

Ernest Moniz, Cecil and Ida Green professor of physics and engineering systems and director of the MIT Energy Initiative and Laboratory for Energy and the Environment, was named to the [Blue Ribbon Commission on America’s Nuclear Future](#).

Mass High Tech named Dava Newman among its “Women to Watch.” Newman is a Margaret MacVicar Faculty Fellow, professor of aeronautics and astronautics and engineering systems, director of TPP, and leader of the bioengineering systems focus area of the MIT–Portugal Program.

Senior lecturer and LGO director Donald Rosenfield was awarded the [2009 Joseph A. Martore \(1975\) Excellence in Teaching Award](#).

Yossi Sheffi, director of ESD, was named the [Elisha Gray II professor of engineering systems](#), effective July 1, 2009.

Professor John Sterman received the Jamieson Prize, the highest teaching award at MIT Sloan School of Management.

Joseph Sussman, JR East professor in the Department of Civil and Environmental Engineering and ESD, was reappointed chair of the US Department of Transportation Intelligent Transportation Systems Program Advisory Committee.

Mort Webster, assistant professor of engineering systems, was selected to receive a grant in the Department of Energy’s new Early Career Research Program. Webster is lead author on a climate risk report by the [MIT Joint Program on the Science and Policy of Global Change](#).

Annalisa Weigel was appointed Charles Stark Draper Career Development assistant professor of aeronautics and astronautics, effective July 1, 2009.

Sheila Widnall, Institute Professor and professor of aeronautics and astronautics and engineering systems, was named an American Institute of Aeronautics and Astronautics

honorary fellow. Widnall won the National Academy of Engineering's Arthur M. Bueche Award and was named to the Toyota North American Quality Advisory Panel.

Alumni Honors

ESD PhD alumnus Jason Bartolomei was selected by the US Air Force to serve as a legislative fellow for a member of Congress. His placement will be finalized in late fall. He will spend the fall preparing and start the one-year fellowship in January 2011.

Honors for graduates of ESD master's programs are described in other sections of this report.

Student Honors

Winners of Best Thesis Awards in ESD programs included Jeffrey Heyman (LGO), Ahmedali Lokhandwala (Supply Chain Management Program), John Kluza (SDM), and Ellie Ereira and Michael Pasqual (TPP).

Several ESD students were recognized at the recent Graduate Women of Excellence event, including Lynette Cheah (ESD PhD program), Rhonda Jordan (ESD PhD program), Sherrica Newsome (TPP), Danielle Wood (ESD PhD program), and Carrie Stalder (SDM).

Below are honors received by ESD PhD students:

Valerie Karplus was awarded a US Environmental Protection Agency STAR Fellowship, which will support her PhD research for up to three years.

Danielle Wood received the [MIT Entrepreneurship Center's 2010 Carroll Wilson Award](#).

ESD PhD student Regina Clewlow was accepted to the IIASA's [Young Scientists Summer Program](#).

Dan Livengood won a [poster award at the MIT-Portugal Conference](#).

Other awards received by students of ESD master's programs are described in other sections of this report.

Employee Recognition

Three ESD staff members were honored with School of Engineering Infinite Mile Excellence Awards in April 2010: Elizabeth Milnes, ESD academic administrator; Patricia Eames, LGO program coordinator; and David Schultz, SDM administrative assistant.

Conferences and Lectures

Brunel Lecture

Alan Davidson, director of government relations and public policy for Google, delivered the annual Brunel Lecture on Complex Systems on November 9, 2009. Davidson, a TPP alumnus, discussed how choices made in Google's product deployments over the last

five years have mitigated or exacerbated public policy impacts on personal privacy, free speech, and economic freedom. Davidson's talk, "[Liberty by Design: An Internet Practitioner's Perspective](#)," is available on [MIT World](#).

Miller Lecture

L. Rafael Reif, MIT provost, delivered the annual Charles L. Miller Lecture on April 29, 2010. The lecture was titled "Challenges and Opportunities Facing MIT: A View from the Provost's Office."

Institute of Electrical and Electronics Engineers Systems Conference

The 2010 Institute of Electrical and Electronics Engineers Systems Conference was held April 5–8 in San Diego, CA. Donna Rhodes, Adam Ross, and Ricardo Valerdi presented papers.

Major Meetings

Alumni Advisory Council

The [ESD Alumni Advisory Council](#) convened on April 29, 2010. Yossi Sheffi gave a brief overview of the division. Webster, Trancik, and Selin gave presentations on their research, all in the domain of energy/environment. Professor de Weck discussed ESD's priorities moving forward.

ESD Meetings

ESD held an off-site meeting on September 3, 2009, focusing on the ESD PhD program. The meeting included a review of the last academic year and a preview of the next one. The division held another off-site meeting at the end of the academic year, on June 2, 2010, that discussed in detail a potential undergraduate offering in engineering systems.

Yossi Sheffi

Director, Engineering Systems Division

Director, MIT Center for Transportation and Logistics

Elisha Gray II Professor of Engineering Systems and Civil and Environmental Engineering

More information on the Engineering Systems Division can be found at <http://esd.mit.edu/>.

Master's Programs

Leaders for Global Operations

The MIT [LGO](#) program, now in its 22nd year, offers an MBA or an SM from the MIT Sloan School of Management and an SM from the MIT School of Engineering. Focused on leadership and teamwork, the two-year LGO experience features a cross-disciplinary curriculum, a global orientation, and internship opportunities.

Academic Program

The LGO curriculum offers a [mix of management and engineering courses](#). LGO students can earn engineering degrees in eight engineering disciplines and can focus on topic areas related to manufacturing and operations in nine engineering tracks:

- Supply chain management (ESD)
- Manufacturing systems (Mechanical Engineering)
- Energy and environmental sustainability (ESD, Civil and Environmental Engineering, and Mechanical Engineering)
- Systems architecture and engineering (ESD)
- Information and decision systems (Electrical Engineering and Computer Science)
- Semiconductor manufacturing (Electrical Engineering and Computer Science)
- Biomechanics (Mechanical Engineering)
- Transportation (Civil and Environmental Engineering)
- Chemical manufacturing systems (Chemical Engineering)

Internships and Research

The LGO Class of 2010 had 47 graduates in June 2010 and one projected for September 2010. Each graduate completed a six-month internship at a partner company. Internships are focused projects of concern to partners and are accomplished by interns with company support and MIT faculty guidance.

LGO '11 had a significant number (15) of international internships, for example in Argentina, Austria, Brazil, France, Italy, Poland, Switzerland, and the United Kingdom. Of these internships, 25% were off-cycle, running from February through August. A number of follow-on internships from the work done by LGO '10 were handed off to LGO '11, leading to a continuity of research.

Admissions

Forty-eight new students (LGO '12) were admitted and began an intensive summer session in June. The class has an average of 4.3 years of work experience, slightly lower than in the previous year. LGO continues to successfully recruit women (who make up 25% of this year's class) and more underrepresented minorities.

The entering Class of 2012, broken down by engineering discipline, is as follows:

- Aeronautics and Astronautics: 1
- Chemical Engineering: 3
- Electrical Engineering and Computer Science: 7
- Engineering Systems Division: 26
- Materials Science and Engineering: 2
- Mechanical Engineering: 9

LGO applications increased by almost 20% (from 239 to 286) compared to last year, indicating a strong return on the recent marketing investment.

Program Leadership and Personnel

Faculty codirectors for the LGO and SDM programs are professor David Simchi-Levi from the MIT School of Engineering and professor emeritus Thomas Allen from the MIT Sloan School of Management. Professor Georgia Perakis from MIT Sloan has assumed the management codirector role. Don Rosenfield continues to serve as the LGO director, while Vah Erdekian remains as industry codirector. Leah Schouten was hired as the new admissions and career development coordinator.

China Leaders for Global Operations

The China Leaders for Global Operations (CLGO) program was established in 2006 to help US companies compete more effectively globally. Twenty-three Shanghai Jiao Tong University (SJTU) faculty members have been trained using MIT Sloan's teach-the-teacher model. In March, 45 LGO students traveled to Shanghai. They spent three days touring plants with their CLGO counterparts and participated in a mixed-team case competition and other social activities. LGO and CLGO students also take part in joint industry projects called Lion Teams. These projects focus on operational issues, involve two teams of six students, and include a weeklong site visit in China.

In January, Tom Allen led the second CLGO review committee, which made recommendations in three areas: increase the program applicant pool via better marketing, find ways to balance engineering and management, and recruit more partner companies. The group traveled to Shanghai, where they met with SJTU deans, faculty, students, and staff. From there they sent a report to the SJTU deans responsible for CLGO. In May, David Simchi-Levi and Don Rosenfield conducted a follow-up visit to monitor progress, participate in the spring CLGO governing board meeting and taking part in the first CLGO graduation ceremony.

LGO Alumni

The LGO 2009 alumni conference on sustainability and the global operations leader drew more than 100 alumni to Portland, OR. Speakers included Michael Brylawski (LGO '04), vice-president of corporate strategy at Bright Automotive; Corinne Dubois, senior sales representative, Office Channel, at Boise Paper; and Hannah Jones, vice-president of corporate responsibility at Nike. The group also held plant tours at local facilities, including Intel's fab wastewater treatment facility, SolarWorld, Bonneville Lock and Dam, Oregon Iron Works, and Schnitzer Steel.

This year, Steve Cook (LGO '98) was elected as the official alumni voice on the LGO operating committee. MIT faculty and LGO and SDM alumni continued to present monthly webcasts and were instrumental in setting up an infrastructure to support LGO. An alumni advisory board, headed by Christy Dorris (LGO '06), was formed to fold all alumni activities into one group that oversees fundraising, the annual conference, operating committee representation, and networking events. Through an organized fundraising effort, alumni established three funds: the William C. Hanson and Don

W. Davis Leadership Fund, the Alumni Annual Fund, and the Endowed Discretionary Fund. Parts of the funds were used for immediate needs and were distributed as follows:

Scholarships for LGO '12: \$38,518

Plant tour support: \$5,000

Funds raised: \$76,815

Speakers at Global Operations Leadership Seminars

LGO students attend weekly on-campus seminars (formerly “proseminars”) with faculty and industry experts to explore local, national, and international manufacturing, leadership, and business issues. The more than 30 speakers in fall 2009 and spring 2010 included Shane Tedjarati, chief executive officer of Honeywell China; Matthew Bromberg, vice-president and general manager, customer service, at Hamilton Sundstrand; Mike McNamara, chief executive officer of Flextronics; Annette Clayton, vice-president, global supply chain, at Dell Inc.; Rick Dauch, president and chief executive officer of Acument Global Technologies; and Kay Hagan, US Senator from North Carolina.

New Visions for Global Operations

In December, MIT and industry thought leaders convened at the 2009 MIT Global Operations Conference to discuss their latest ideas on product design, delivery, and distribution. Speakers from around the Institute and across industries explored cutting-edge concepts for designing, manufacturing, distributing, and recycling products, as well as innovative new ways to configure operations in a global environment.

Plant Tours

Local plant tours were held at Raytheon–IDS, Amgen Inc., Novartis Institutes for BioMedical Research, United Technologies Corporation–Pratt & Whitney, and Gorton’s. Students in the annual two-week plant trek visited the Boeing Company in Seattle; Amazon.com in Phoenix; Amgen Inc. in Thousand Oaks, CA; Dell Inc. and Cisco Systems/Flextronics in Austin, TX; Novartis Vaccines & Diagnostics in Holly Springs, NC; and General Motors (GM) and the Ford Motor Company in Detroit. The LGO International Plant Tour traveled to China and Japan to visit Caterpillar Inc. in Suzhou, the Shanghai Automotive Industry Corporation, the Toyota Tsutsumi assembly plant in Toyota City, and Hitachi’s nuclear fuel-processing plant near Tokyo.

Career Development

Sponsored and non-sponsored LGO students are highly sought after upon graduation. Partner companies and other organizations take a special interest in LGO students, as indicated by their active participation in the Global Operations Leadership Seminar session and recruiting week. Of the 2010 class to date, 94% have accepted positions in manufacturing and operations companies and 40% of these are in partner companies.

Governance

LGO is run by a governing board of senior officers from the managing partner companies, program codirectors, and MIT deans, and is co-chaired by Jeff Wilke of Amazon.com and Larry Loftis of Boeing. The operating committee, chaired by industry codirector Vah Erdekian, handles ongoing program management and includes company representatives, faculty, and directors.

The program honored Gary Cowger, former governing board member representing GM and recently retired president of global manufacturing and labor relations for GM. At a reception for the program's combined governing board, operating committee, and newly matriculated class of 2012, MIT and industry speakers emphasized the key role that companies like GM and executives such as Cowger have played in the success of LGO.

New Partners

An active student, staff, and company committee has succeeded in bringing new partners to LGO. Caterpillar Inc., National Grid, and SanDisk Corporation joined last year, and several other companies are expected to come on board this fall.

LGO Awards

Don Rosenfield: 2010 Joseph A. Martore (1975) Excellence in Teaching Award, sponsored by ESD

Angela Thedinga: Siebel Scholar of the Siebel Foundation

Patricia Eames (staff): MIT School of Engineering Infinite Mile Award 2010

Andres Garro, Steve Wessels, Kevin Leiter, and Tim Vasil: 2009 Sloan Peer Recognition Award

Kacey Fetcho-Phillips: New Faces of Engineering 2010 Award from the National Engineers Week Foundation and National Society of Professional Engineers

Wendy-Kay Logan, Tabassum Rahman, Julia Reed, and Noramay Cadena: fifth annual MBA Exclusive Case Competition

Ben Wheeler: INFORMS 2009 Daniel H. Wagner Prize for Excellence in Operations Research Practice

Leo Espindle: Lincoln Laboratory Best Paper

Tom Allen, Codirector

Howard W. Johnson Professor of Management, Emeritus and Professor of Engineering Systems, Emeritus

David Simchi-Levi, Codirector

Professor of Civil and Environmental Engineering and Engineering Systems

Vah Erdekian, Industry Codirector

Don Rosenfield, Director, LGO Program

More information on the Leaders for Global Operations program can be found at <http://lgo.mit.edu/>.

Master of Engineering in Logistics

In spring 2009, 33 students were selected from more than 240 applicants to join the center's MLOG program as the Class of 2010. MLOG is an intensive nine-month degree track that prepares graduates for supply chain management careers in various industries, including manufacturing, distribution, retail, transportation, and logistics services. The MLOG Class of 2010 was geographically dispersed, with 40% coming from outside the United States, representing 11 countries and five continents.

Campus recruiting activity continued to grow, with 58 companies targeting the MLOG program via information sessions, résumé drops, and interviews in AY2010. While the economy is still difficult, 92% of the students had one or more job offers by graduation. As in the past, the program had a significant impact on the salary level of the class, with a median outgoing base salary of \$105,000, representing a 62% increase over the median incoming base salary.

Master of Engineering in Logistics Alumni Interaction

CTL held its fourth annual MLOG reconnect event in March 2009. This one-day event—which is open to MLOG alumni, current MLOG students, and incoming MLOG students—featured an update of CTL and MLOG/ZLOG (the sister program in Zaragoza, Spain) programs by the directors, presentations by CTL researchers, and a professional development keynote by Lalit Panda, chief information officer for D&M Holdings Inc. The event incorporated more than 30 alumni and current students.

Supply Chain Education Partners Program

This year, 13 companies participated in the [Supply Chain Education Partners Program](#), which promotes supply chain knowledge sharing among leading executives and students in the MLOG program. A team of students is assigned a jointly planned project that has both practical and research aspects. This year's projects included:

Suggested Strategies and Best Practices in Private Supply Chain Disaster Response – Caterpillar Logistics Impact of Bidding Aggregation Levels on Truckload Rates – CH Robinson

Multi-Echelon Inventory Management for a Fresh Produce Retail Supply Chain – Chiquita

How to Utilize Hedging and a Fuel Surcharge Program to Stabilize the Cost of Fuel – General Mills

Risk from Network Disruptions in an Aerospace Supply Chain – Lockheed Martin

Modeling Supply Chain Benefits of Efficient Assortment – Procter & Gamble

Incorporating Traffic Patterns to Improve Delivery Performance – Pepsi Bottling Group

Distribution Network and Inventory Strategies for Rapid and Cost-Effective Deployment of Oilfield Drilling Equipment – Schlumberger

Distribution Network Consolidation and Optimization for a Large Industrial Conglomerate – Siam Cement

Environmental, Operational, and Financial Sustainability of Packaging Methods by Delivery Businesses – Staples

Using a Total Landed Cost Model to Formulate Global Logistics Strategy in the Electronics Industry – Tyco Electronics

Addressing Demand Variability in Transportation Planning Using Robust Planning Methodologies – Wal-Mart

Aftermarket Vehicle Hybridization: Designing a Supply Network for a Startup Company – XL Hybrids

In addition, the following pro-bono projects were conducted with non-profit organizations:

Managing the Growth of a Non-Profit Healthcare Supply Chain in Haiti – Partners in Health

WFP Supply Chain Capacity in Ethiopia: An Analysis of Its Sufficiency, Constraints, and Impact – World Food Programme

Finally, just before the end of FY 2010, the highly successful MLOG program was rebranded to better reflect the focus and course load. The new name of the program, starting in FY 2011, will be the MIT Supply Chain Management program. This program will still culminate in the [master of engineering in logistics degree](#). A new identity for the program has been created, and a new website will launch in August 2010.

System Design and Management

Patrick Hale continues as director for his sixth year. In January 2010, Pat stepped down from the role of president of the International Council on Systems Engineering (INCOSE) after serving in that capacity from 2008 to 2009. This role has provided the program a high level of visibility in an organization of industry and educational institutions aligned with the SDM academic mission. Pat's tenure as INCOSE president ended in January 2010; however, he continues to serve INCOSE's board of directors as co-chair of the nominations and elections committee.

Tom Allen and David Simchi-Levi stepped down as SDM's academic codirectors in the spring. We are grateful for their dedication and service to SDM. SDM's new academic codirectors are Warren Seering from the School of Engineering and Steven Eppinger from the MIT Sloan School of Management. Both are experts in the field of product development and design and worked with SDM during its founding. We are thrilled that they are leading SDM.

John M. Grace retired as SDM's industry codirector. John made significant contributions to SDM, most notably in working with the students on the Industrial Relations Committee. A search is under way for his successor.

Student Statistics

In January 2009, SDM admitted its 14th class, enrolling 53 students. As was done in the previous academic year, SDM held several information evenings for local MIT alumni and others interested in SDM as a way to recruit prospective students for SDM '10 and '11. SDM hosted an information evening in February for members of the local chapters of the Society of Women Engineers (SWE) and the Society of Hispanic Professional Engineers. These successful events brought more than 100 prospective students to campus and suburban locations, where they heard presentations on the program. In addition, for the second year in a row, SWE presented SDM with a certificate of appreciation at its annual awards banquet in June.

System Design and Management Student Statistics, AY2011–AY2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Admitted	37	27	36	37	62	58	61	56*	64	53
On campus	8	7	18	27	44	44	47	40	34	46
Self-supported	2	1	6	25	42	34	40	36	27	29
Research assistant	3	1	10	0	0	2	1	4	0	14
Distance education	29	18	17	10	18	14	14	16	19	10
Company sponsored	32	25	20	12	20	24	21	20	37	17

* In addition, seven naval officers from Course 2N were admitted for a second degree program.

Distance Education Delivery

SDM continues to evaluate its distance education delivery with the goal of increasing the quality of the remote learning experience while reducing costs both for MIT and for sponsoring companies. This process includes streaming all classes on the web so that students who cannot attend a session can view the video of it almost immediately.

Sponsoring Theses of Self-Funded System Design and Management Fellows

In the past few years, companies have also engaged the program by using self-funded fellows for research internships that they develop into SDM theses. Support typically involves identifying a thesis topic and naming a company mentor to work with a student and MIT faculty member on a topic of pressing concern.

SDM Industry Partners and the MIT Graduate Certificate in Systems and Product Development

SDM has continued to develop its relationship with industry. One area that is a focal point is the MIT Graduate Certificate Program in Systems and Product Development, now in its ninth year. Partners have included United Technologies Corporation (UTC), John Deere, Cummins, Draper Laboratory, Instrumentation Laboratory, and Booz Allen Hamilton, among others. With its active participation in all levels of the program, UTC now has more than 250 employees who have benefited from the SDM program.

Career Development for SDM Self-Sponsored Students

Led by career development director Helen Trimble, SDM has provided career services to its self-funded students for the past six years. Preliminary data indicate that this year's graduates will achieve the same success as in previous years with one hundred percent employment in various industries and organizations. Recent students are tending toward energy, start-ups, and venture capital firms.

MIT-SDM Conference on Systems Thinking

In the past, SDM has held an annual conference for SDM alumni only that was planned and executed by our alumni. In 2008, the decision was made to open the conference to all in order to give SDM and the field of engineering systems wider visibility. On October 22–23, 2009, SDM sponsored the second annual MIT-SDM Conference on Systems Thinking for Contemporary Challenges, which was attended by more than 200 faculty and students from MIT and other universities, SDM alumni, and industry executives.

Awards

SDM student John Kluza received the SDM Best Thesis Award for his work titled "Status of Grid Scale Energy Storage and Strategies for Accelerating Cost Effective Deployment."

SDM logistics coordinator Dave Schultz received an Infinite Mile Excellence Award from the School of Engineering.

Steven Eppinger, Codirector

General Motors Leaders for Global Operations Professor of Management Science and Engineering Systems

Warren Seering, Codirector

Weber-Shaughness Professor of Mechanical Engineering and Engineering Systems

Patrick Hale, Director, SDM Fellows Program

More information about the System Design and Management Program can be found at <http://sdm.mit.edu>.

Technology and Policy Program

TPP is an interdisciplinary, graduate-level program focusing on issues at the interface of technology, society, and the sociotechnical aspects of complex systems. TPP is dedicated to educating engineers and scientists who wish to lead in the development and implementation of responsible technology strategies and policies to benefit humankind.

Students

TPP offers a two-year master's of science program and supports the ESD PhD doctoral program by encouraging dissertation research in the areas of technology, management, and policy (TMP). While TPP receives most of its applications from outside MIT, several

internal admits (i.e., students already enrolled in other MIT graduate programs) join TPP each year; roughly one-third of TPP students concurrently pursue a second master's or a doctoral degree in another department. Each entering class averages 40 students, comprising more than 40% women, less than 40% international students, and more than 10% underrepresented minorities (URM) for the past five years. This year, 46 students graduated with master's degrees in technology and policy, and seven TPP students were accepted to continue their ESD doctoral studies.

Entering Technology and Policy Students, AY2010

	US	International	Total
Male	13	10	23
Female	9	7	16
Total	22	17	39

Fellowships

This year funds came from the Rabinowitz and de Neufville Funds as well as a tuition-only Keil Fellowship. The Office of the Dean for Graduate Education also provided matching fellowship funding to TPP students, specifically for URM students. With these fellowships, TPP has achieved an almost 100% yield of our admitted URM students over the past five years. Additional funds have been generously provided by TPP alumni and donors for several student or program initiatives, including funding for summer internships, recruitment and outreach, support for TPP women student events, and support for some of the costs associated with the TPP visiting speaker series and alumni relations.

TPP Research

All TPP students are funded for their graduate studies with full or partial research assistantships or fellowships in a wide range of research areas across MIT, with the majority in the School of Engineering. Many of the students are working at MIT's Energy Initiative (MITEI), where they study the technology and policy issues impacting energy choices, sustainability, and the environment. MITEI was created in response to the Energy Research Council recommendations following President Susan Hockfield's inaugural challenge to create better energy systems.

TPP faculty continue to lead the MIT-Portugal Program in bioengineering systems, sustainable energy and transportation, and design-inspired products, while our students are pursuing collaborative international research projects in engineering systems and work with faculty from across the Institute.

Although financial support from the Cambridge-MIT Institute has ended, TPP maintains a mentoring/advising relationship with the Technology Policy master of

philosophy program at Cambridge University. Professor Newman served as the external examiner of the Cambridge University TPP program from 2006 to 2009.

TPP has continued its leadership and participation in the collaborative and interdisciplinary Program on Emerging Technologies (PoET), along with ESD; the Program in Science, Technology, and Society (STS); the Center for International Studies (CIS); and the Department of Political Science. PoET was awarded a five-year \$2.97 million grant from the National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) program. PoET aimed to improve responses to emerging technologies by increasing understanding of the economic, security, environmental, and cultural implications of technological advances and the uncertainties surrounding them. As the program enters its closing year of NSF funding, we are working to find ways to maintain this important area of inquiry. PhD students from ESD, CIS, and STS are funded by PoET IGERT traineeships. Visit <http://poet.mit.edu/> for more information.

TPP Policy Internship Program

The annual TPP trip to Washington, DC, was held in March this year, with 10 TPP students learning more about technology policy internship and career opportunities. TPP alumni arranged and hosted informational presentations at the US Departments of State, Transportation (USDOT), and Health and Human Services; the Environmental Protection Agency; the World Bank; the American Association for the Advancement of Science (AAAS); SRI International; and Phase One Consulting. The visit was capped by a well-attended TPP alumni reception.

Funds from our generous alumni and donors, including the Far East Organization, Larry Linden, Donald Cooke, and Francis Chin, make it possible to provide valuable internship experiences. This year TPP sent two MIT students to the Far East Organization in Singapore and three students to India and Africa for technology and development internships. Several additional TPP students are pursuing paid technology policy internships in the US and abroad.

TPP Curriculum

This past year ESD.10 Introduction to Technology and Policy was taught by TPP director of education Frank Field and professor David Marks. This year's course was revised to challenge the students to think more deeply about the role of modeling in the formulation of policy research, with a particular emphasis on systems modeling. The student team term project immersed students in the activities of the MIT task force, and students examined particular research, educational, and service units at MIT. Students continue to thrive in both 14.003 Microeconomic Theory and Public Policy and 15.011 Economic Analysis for Business Decisions to fulfill their economics requirement.

TPP Alumni Surpass 1,000

In our 34th year at MIT, TPP alumni passed the 1,000 mark. We continue to foster a strong alumni community by bringing alumni back to campus, providing current alumni updates, publishing a biannual alumni directory, and having regional gatherings in Washington, DC, and Boston. Approximately 50 people, including more than 30

local alumni, attended last March's gathering in Washington, DC. Other TPP alumni receptions are held occasionally in Boston, New York, Paris, Singapore, and Tokyo.

Conferences and Workshops

TPP is a founding member of the Technology, Management, and Policy (TMP) Graduate Consortium, which includes programs in North America, Europe, and Asia and allows TPP students and ESD doctoral students to share their research and network with students in sister programs across the globe. At the consortium's ninth annual conference, hosted by the University of Cambridge, June 27–29, 2010, six MIT students presented their research.

Avi Wolfson (TPP '10) and Ruth Krestin (TPP '10) organized a workshop on the government's role in commercialization of biotechnology. Sebastian Pfotenhauer (TPP '10) formed a local interuniversity group focused on science, technology, and policy for students from MIT, Harvard, Boston University, and Tufts; they held the first science, technology, and policy crossroads student-led symposium to explore the intersection of these issues.

Current TPP students also lead many organizations and clubs across the Institute, most notably the MIT Energy Club. This year's club co-president was Tim Heidel (TPP '09), club secretary was Ellie Ereira (TPP '10), club social co-chair was Pearl Donohoo (TPP '10), and other club officers included Manya Ranjan (TPP '10) and current TPP students Jordan Kwok and Kevin Huang. The annual MIT Energy Conference featured leadership by several TPP students, including Lara Pierpoint (TPP '08 and current ESD PhD candidate) and Addison Stark (TPP '10) (who were the 2010 conference content codirectors), the conference managing director Paul Murphy (TPP '10), and several additional TPP students who served in key positions.

Faculty and Student Honors

Dava Newman was appointed to the NASA [Advisory Council](#) Committee on Technology and Innovation, where she will provide advice to NASA and help shape the agency's new direction. Newman has also accepted a position on the International Advisory Board of the Politecnico di Torino where she will offer advice primarily on their new human space robotics initiative. On campus, she is leading the Exploration Symposium with colleagues from ESD; Aeronautics and Astronautics; Mechanical Engineering; Earth, Atmospheric and Planetary Sciences; Physics; the School of Humanities, Arts, and Social Sciences; and the Woods Hole Oceanographic Institute, which will take place in April 2011 as part of MIT's 150th anniversary celebration.

The 2010 TPP Faculty Appreciation Award was given to professor Amedeo Odoni and Dr. Ricardo Valerdi.

The TMP Consortium Best Master's Presentation was awarded to Ruth Krestin (TPP '10) and Julio Pertuze (TPP '09 and current ESD PhD student).

Dr. Sebastian Pfotenhauer (TPP'10) was awarded best paper at the Science and Technology in Society Conference sponsored by the National Academies, AAAS, and the STGlobal Consortium.

Incoming TPP student Amanda Cuellar has been awarded a Lemelson Presidential Fellowship and incoming TPP student Lisa Schlecht has been awarded an Ida Green Fellowship. Continuing TPP student An Vu has won a Legatum Fellowship.

TPP Student Society

The Technology and Policy Student Society (TPSS) continues to be one of the most active student groups on campus. TPSS holds yearly elections for officers representing the broad spectrum typical of TPP students. The society organizes talks, workshops, and social events and also plays an important role in the annual TPP open house for the admitted incoming student class. Generous donors have provided funding for many TPSS activities.

Dava Newman

Director, Technology and Policy Program

Professor of Aeronautics and Astronautics and Engineering Systems

More information about the Technology and Policy Program can be found at <http://web.mit.edu/tpp/>.

Center for Engineering Systems Fundamentals

This was another year of significant research and educational results for the Center for Engineering Systems Fundamentals (CESF). CESF benefited from the following support:

Demand-side electricity management—MIT ESD Portugal Project, \$100,000

PANDEMIC INFLUENZA: *Social Distancing & Hygienic Policies to Reduce its Prevalence*—the Sloan Foundation of New York, \$350,000

A five-year cooperative agreement with the US Centers for Disease Control and Prevention—“LAMPS (Linking Assessment and Measurement to Performance in PHEP Systems),” awarded to the Harvard School of Public Health Center for Public Health Preparedness and CESF, \$8,000,000 total, approximately 25% for the MIT effort

BLOSSOMS, *Blended Learning Open Source Science or Math Studies*—funded by the William and Flora Hewlett Foundation, the Sloan Foundation of New York, the Lord Foundation of Massachusetts, and, new this year, the Lounsbury Foundation.

Social Distancing in an Influenza Pandemic

CESF is in year four of a multi-year research project, “Decision-Oriented Analysis of Pandemic Flu Preparedness and Response,” with principal investigator Richard Larson and co-principal investigator Stan Finkelstein. The research support now includes a

five-year grant from the Centers for Disease Control and Prevention in conjunction with partners at the Harvard School of Public Health. For the latter grant, Finkelstein is principal investigator and Professor Larson is co-principal investigator.

Professor Larson serves on two boards of the Institute of Medicine (IOM): the IOM Standing Committee on Emergency Management and Medical Response Integration (renamed the IOM Standing Committee on Medical Readiness) and the IOM Health Sciences Policy Board. On September 2–3, 2009, Dr. Larson was the only engineer invited to a White House conference on the H1N1 influenza; the purpose of the meeting was to plan the federal response to this pandemic.

The Energy Box

Supported by the MIT–Portugal Program, the Energy Box is being designed and created as an Open Source software system to manage silently in the background—from an available desktop computer—the electricity usages of a home or small business. We are in the fourth year of Energy Box research. Substantial progress has been made by an extended team of students and faculty members, both at MIT and in Portugal. At CESF, the two key PhD students are Dan Livengood and Woei Ling Leow.

Urban Traffic Congestion: Congestion Pricing for Parking

We developed a queuing model allowing impatient drivers to abandon the queue and to settle for expensive off-street parking. Reducing the number of “patrolling drivers” often can reduce urban road congestion significantly. Katsunobu Sasanuma, as a TPP student, completed this research as part of his master’s thesis in August 2009, supervised by Professor Larson.

MIT LINC

MIT LINC is the Learning International Networks Consortium (<http://linc.mit.edu>). **LINC 2010**, our fifth LINC conference, was on May 23–26, 2010. More than 200 attendees from 40 countries participated. This diverse group enthusiastically exchanged a wealth of ideas and connections for educational practices over a wide range of global regions and technological conditions. There were 17 plenary **speakers**, headed by keynote speaker Dr. Charles M. Vest, president of the National Academy of Engineering and former president of MIT.

BLOSSOMS

Daniel Frey is co-principal investigator, M. Elizabeth Murray is project manager, and Richard Larson serves as principal investigator. During this past year, we have surpassed our goal of completing 40 BLOSSOMS video learning modules and have added Lebanon to our growing list of country partners. We gave six teacher training workshops: one in New York City; one in Providence, RI; and four at MIT. We have agreements in place to implement BLOSSOMS in Massachusetts (via Project ABLE), Rhode Island (especially with the Rhode Island Science Teachers Association), Delaware, and Washington, DC.

Service Science, Management, and Engineering (SSME)

In spring 2008, CESF convened a series of meetings to see how ESD might focus more research on the service industries. These meetings were followed by intense interest by IBM as a potential major supporter of a new research center at MIT in service science, particularly services pertain to urban settings (i.e., urban services). Specific activities included a major trip by Larson to IBM's Almaden Research Laboratories in northern California in January 2010 followed by a major all-day MIT conference with IBM on April 1, 2010. Intense back-and-forth communications have followed as we build toward the design of a new Center for Research and Education in Urban Services.

Outreach

Richard Larson was an invited participant: "Complexity of Higher Education in the Developing World." The conference was sponsored by the National Academies, Keck Foundation, Boston University Provost Office, and the Pardee Center for the Study of the Longer-Range Future at Boston University. October 27–28, 2009.

Richard Larson was an invited participant: "WISE, World Innovation Summit on Education." Qatar, November 15–18, 2009.

Richard Larson and M. Elizabeth Murray were invited speakers: "BLOSSOMS 2010 Open Educational Resources Conference." Yale University, New Haven, CT, April 8–10, 2010.

MIT BLOSSOMS (Blended Learning Open Source Science or Math Studies), with M. Elizabeth Murray. Sloan-C Symposium, Orlando, FL, October 29, 2009. Available online: <http://myaln.sloanconsortium.org/events/event/363>.

INFORMS National Conference. San Diego, CA, October 11–14, 2009.

Invited plenary presentation: "Worldwide Reach into High School Math and Science Classes"

"Engineering the Response to a Pandemic" with Dr. Karima Nigmatulina

"The 2009 H1N1 Virus: What is Happening?" with Dr. Stan Finkelstein.

Other International Outreach

Professor Larson and two other senior MIT faculty members have been serving on the senior advisory board of Lahore University of Management Science, School of Science and Engineering (SSE LUMS); LUMS is a major private university in Pakistan patterned after MIT and the India "IITs." The new SSE school at LUMS opened on September 1, 2008. Dr. Larson was named chair of the advisory board of SSE LUMS.

Richard Larson

Director, Center for Engineering Systems Fundamentals

Mitsui Professor of Engineering Systems and Civil and Environmental Engineering

More information about the Center for Engineering Systems Fundamentals is available at <http://cesf.mit.edu/>.

Center for Technology, Policy, and Industrial Development

The Center for Technology, Policy, and Industrial Development (CTPID) brings together more than 56 faculty members, researchers, students, and staff from the fields of engineering, management, health sciences, and social sciences to approach the complex issues that shape modern economies. CTPID is funded by 15 industry sponsors and nine government agencies for a total research expenditure volume in FY2010 of about \$4.7 million and a total administered research volume of \$6.2 million. CTPID FY2010 projects included projects in the MIT Center for Biomedical Innovation, the Ford–MIT Alliance (both administered by CTPID), the International Motor Vehicle Program (IMVP), Lean Advancement Initiative (LAI), the MIT Information Quality program (MITIQ), Systems Engineering Advancement Research Initiative (SEARi), and the Technology and Law (T&L) program.

The acting director of CTPID is professor Joel Moses, Institute Professor and professor of computer science and engineering systems. Lissa Natkin is the CTPID administrative officer.

Highlights

The MIT Center for Biomedical Innovation (CBI) and Sanofi-Aventis entered into an alliance to advance knowledge in the area of human health through basic and applied research.

CBI negotiated a master research agreement with Novartis Biologics to support projects in biomanufacturing and other areas of strategic interest.

LAI announced the launch of the new quarterly journal, the *Journal of Enterprise Transformation*.

The former director of MITIQ, Dr. Richard Wang, continues his service on an intergovernmental personnel act mobility program to the US Army as chief data quality manager.

In November 2009, MITIQ hosted the 14th International Conference on Information Quality held overseas for the first time at the Hasso-Plattner Institut in Potsdam, Germany.

Awards and Recognition

Jorge Fradinho Oliveira, a doctoral candidate with ESD and LAI, has been honored with the School of Engineering 2010 graduate teaching award.

Ricardo Valerdi of LAI received a Best Thesis Supervisor award from TPP. He also received the 2010 Best Journal Article of the Year award in the *Systems Engineering* journal, was a 2010 finalist for the best paper competition in *Defense Acquisition Review Journal*, and received the 2009 Best Paper award at the Seventh Conference on Systems Engineering Research.

Center for Biomedical Innovation

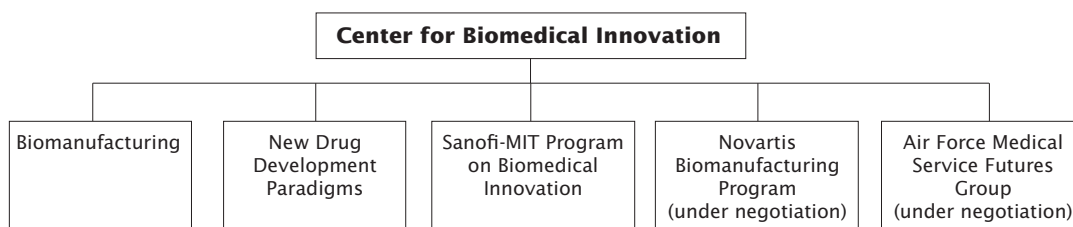
CBI was formed in 2005 as a collaboration among the School of Engineering, the MIT Sloan School of Management, the School of Science, and the Harvard–MIT Division of Health Sciences and Technology to address challenges within the pharmaceutical, biotechnology, diagnostics, and medical devices industries involving innovation, productivity, costs, and the prediction and management of risks. Led by executive director Gigi Hirsch, MD, and faculty director Anthony Sinskey, ScD, CBI's mission is to improve global health by overcoming obstacles to the development and implementation of biomedical innovations.

Research at CBI

CBI encompasses two types of research programs:

Modules of inter-related collaborative research activities and discussion forums sponsored by a cross-stakeholder consortium of participants

Modules of inter-related research activities sponsored by a single institution



Biomanufacturing Research Program

The Biomanufacturing Research Program (BioMAN) develops innovative tools and technologies that reduce the cost of manufacturing processes and improve our ability to deliver safe high-quality biopharmaceutical products. This year, CBI continued collaborative projects led by Anthony Sinskey and Rajeev Ram to validate disposable microscale bioreactor systems in collaboration with CBI industrial partner Millennium Pharmaceuticals, and completed a research project in collaboration with Johnson & Johnson in which a model examining the impact of economic and political instability on siting decisions for offshore biologics manufacturing was created. BioMAN also won a \$250,000 grant from the Alfred P. Sloan Foundation to study the regulatory economics of global biopharmaceutical manufacturing. The cross-disciplinary team of co-principal investigators includes professors Sinskey (MIT), Scott Stern (MIT), Roy Welsch (MIT), Jeff Macher (Georgetown University), and Reuben Domike (University of Prince Edward Island).

BioMAN submitted an application for a bioengineering research partnership grant for \$5.7 million dollars to the National Institutes of Health for an effort called scalable technologies for reliable and effective advanced manufacturing (STREAMBio). This proposed research involves a collaboration among seven MIT faculty: Anthony Sinskey and Jianzhu Chen (Biology); J. Christopher Love, Joel Voldman, and Michael Strano (Chemical Engineering); and Rajeev Ram and Mehmet Fatih Yanik

(Electrical Engineering and Computer Science). The proposed work will lead to major improvements in our ability to safely and efficiently produce antibody therapeutics and biosimilars.

BioMAN held a summit at MIT in November 2009 with panel discussions on “Customized Therapies and Biomanufacturing: The Economic, Regulatory and Technological Implications” and “Globalization of Biomanufacturing: Safety and Economic Ramifications” and focused presentations on biomanufacturing and immunogenicity.

NEW Drug Development ParaDIGMS Initiative

CBI’s NEW Drug Development ParaDIGMS Initiative (NEWDIGS) initiative, launched in May 2009, focuses on designing and implementing transformation improvements to systems of therapeutic product innovation in health care. Specific objectives include reducing cost and time to market, improving knowledge about the benefits and risks of new products, and producing products that are more effective than existing therapeutic options. A convergence of major forces of change (e.g., economic, political, and technological) across the global health care industry provides MIT and NEWDIGS with an unusually robust opportunity to affect public health in substantial ways.

NEWDIGS is launching a collaborative test bed in which innovative technology, process, and policy paradigms will be rigorously evaluated in terms of their scientific merit and their impact on predefined performance metrics. The first NEWDIGS research project focuses on regulatory adaptation and learning: insights from within and beyond health care (principal investigator Kenneth Oye in collaboration with his research scientist Lawrence McCray, PhD, former founding director of the Policy Division, National Research Council of the National Academy of Sciences and former director of regulatory policy reform, Environmental Protection Agency). Dan Frey will likely formalize a collaboration with Oye and McCray in the next phase of this research project, which will focus heavily on the technical elements of the new regulatory paradigms now being explored in NEWDIGS.

Discussions are under way with the US Food and Drug Administration about a collaboration related to activities in NEWDIGS as well as needs they have related to their new Computational Science Center.

Sanofi-Aventis Biomedical Innovation Program

On May 5, 2010, Sanofi-Aventis entered into an alliance with CBI to advance knowledge in the area of human health through basic and applied research and to promote scientific exchange that mutually benefits both parties. Sanofi-Aventis committed \$4.2 million dollars over the next three years to fund a biomedical innovation award program and CBI will continue to work with Sanofi-Aventis to grow this program and catalyze collaborations in the biomedical innovation space across campus.

Novartis Biologics Master Research Agreement

CBI has negotiated a master research agreement with Novartis Biologics. This nearly finalized agreement will support projects with Novartis Biologics in biomanufacturing and other areas of strategic interest to both Novartis and MIT. The initial funding will

be for approximately \$1.2 million dollars and will fund projects in the laboratories of Michael Strano and Alexander Klibanov.

Air Force Medical Services Futures Group

CBI has been collaborating with a special team assembled by the Air Force surgeon general over the past year on a future scenario planning initiative for its medical system. A negotiation is under way for establishing CBI as the academic hub for the implementation activities that will follow.

Additional CBI Research Projects

Further information is available upon request about the following additional CBI research projects: stratified medicine research group (professor Ernst Berndt and collaborator Mark Trusheim) and strategic allocation of clinical trials (professor Ernst Berndt and collaborator Dr. Fabio Thiers).

Ford-MIT Alliance

The Ford-MIT Alliance, an Institute-wide initiative, was established in 1997. During December 2006, it was renewed for its third five-year term at \$3 million annually, beginning January 1, 2008, and running through 2012. In 2007, Ford joined MITEI as its first sustaining member with participation on its executive committee by Ford vice president Sue Cischke.

During the past two years of economic constraints for the global automotive industry, Ford requested that MIT honor its corporate requirement to cut services by 30%. In response to this request, Ford elected to drop its membership in MITEI and also implemented a 30% cut in the management budget for operating the Alliance. The research portfolio was not affected; however, through an amendment to the Alliance Agreement, Ford asked that MIT accept the annual payment as two separate checks for this year in the sum of \$2.1 million.

Professor John Leonard is the new director of the Alliance, replacing professor John Heywood. Ford has introduced an annual project selection process, which involved proposals submitted by MIT faculty and researchers upon request by Ford as well as an MIT-organized white paper process, which resulted in 52 submissions. Within this process, seven projects were selected, the majority running for two years. The portfolio began in June 2010, including two projects with new Sloan School of Management faculty.

The portfolio is managed by an operating committee, including codirectors John Leonard and Ed Krause for Ford, MIT Alliance executive director Elaine Savage, and Bob Karp for the Industrial Liaison Program. The operating committee reports to an executive committee, including MIT's leadership champion, chancellor Phillip L. Clay, and works in close partnership with Ford's key executives, including the chief technology officer and vice president of research for Ford. The Alliance hosts the executive committee on campus twice annually and once in Dearborn. This year, the first meeting occurred June 25 at MIT. Project kickoff meetings were held on June 24 with Ford and the Industrial Liaison Program present.

Ford–MIT Alliance Research Activities

Ford–MIT Alliance research focuses on key areas such as innovative battery technology, the driving experience, active safety, fuel economy, powertrain, and consumer practices. Through an active operating committee on campus, next-generation technologies are rapidly investigated for application of the Institute’s capabilities to Ford’s research areas. MIT researchers involved in Alliance projects have come from areas such as Mechanical Engineering, Materials Science, the Sloan School of Management, the Center for Transportation and Logistics, the Laboratory for Information and Decision Systems, and the Computer Science and Artificial Intelligence Laboratory.

International Motor Vehicle Program

IMVP leadership remains the same as in the previous academic year. Professor John Paul MacDuffie, Wharton School, University of Pennsylvania, continues to serve in his role as IMVP codirector and shares that responsibility with professor Charles Fine, MIT Sloan School of Management. Daniel Roos continues to serve as chairman of the IMVP advisory board. The part-time role of IMVP senior director for global strategy and sponsor development is currently not active because of funding constraints.

IMVP is fully funded by industry sponsors. Our current financial situation is quite challenging, with only Toyota Motor Company remaining as an active sponsor. We have addressed this challenge by reducing research grants and administrative expenses and by obtaining outside funding for the researchers’ meeting held in 2009–2010. Internationally, we continue to pursue sponsorship with companies such as Renault and Hyundai. Multiple companies, including Ford and Toyota, have said we should return to them to discuss funding once economic conditions improve.

IMVP continues its formal affiliation with the new Industry Studies Association (ISA), created to take over from the Sloan Foundation Industry Studies program. John Paul MacDuffie and IMVP researcher Susan Helper are board members of ISA.

Thanks to the generous support of Volkswagen and the Wissenschaftszentrum Berlin für Sozialforschung (WZB, Social Science Research Center, Berlin), IMVP held two events in Germany in November 2009. On November 6 at the VW Auto University in Wolfsburg, there was a daylong workshop featuring speeches and presentations by IMVP researchers and VW executives on topics relating to manufacturing, supplier relations, engineering, and the future of the auto industry. On November 7, the IMVP researchers traveled to the WZB in Berlin to hold a half-day researchers meeting.

Although direct funding of research projects was again suspended this year, IMVP researchers continued to be active in pursuing their research and writing and participating in academic conferences. Through the dedicated efforts of the benchmarking research teams, we are continuing to make steady progress in gathering data for IMVP’s three ongoing global benchmarking studies: International Assembly Plant Survey; Vehicle Engineering Survey; and Innovation and Advanced Engineering. With the headline-making news in the global automotive industry this year, IMVP researchers were active in speaking with and writing for various major media outlets. They also were mentioned in numerous [Knowledge@Wharton](#) articles and in various additional international and non-English-language publications.

The Lean Advancement Initiative

The **Lean Advancement Initiative** (LAI) works with its members from government, industry, and academia to enable the effective and sustainable transformation of complex enterprises. LAI produces a unique body of research, methodologies, products, and tools and, in partnership with its members, identifies and shares best practices, common goals, and strategic tools built upon collaborative member experiences. LAI's Educational Network (EdNet) is an international consortium of colleges and universities that translate LAI research findings and practitioner knowledge into curricula. EdNet includes some 60 educational institutions on five continents.

LAI Leadership

Three executive board co-chairs from government, industry, and academia govern LAI. They include

Blaise Durant (Office of the Assistant Secretary of the Air Force), Luis Izquierdo (vice president of corporate operations, Raytheon Company), and Institute Professor Sheila Widnall (MIT)

LAI's codirectors are professor Deborah Nightingale, MIT Department of Aeronautics and Astronautics and ESD, and professor John Carroll, MIT Sloan School of Management and ESD. Richard Lewis serves as LAI's executive director.

LAI Research

LAI's research program is structured around four collaborative teams that are headed by both an MIT faculty member and research lead and include associated faculty advisors and graduate student researchers. These teams are focused on:

- enterprise transformation/enterprise architecting
- enterprise systems engineering
- lean enterprise product development
- enterprise change management

LAI's four research areas are:

1. Motivation for enterprise transformation/enterprise architecting
2. Motivation for enterprise systems engineering
3. Motivation for enterprise lean product development
4. Motivation for enterprise change capabilities

New Research Areas

LAI at MIT has entered into a partnership with the US Department of Defense (DoD), Office of the Secretary of Defense (OSD). LAI will be working with OSD's deputy chief management officer, Elizabeth McGrath, to assess DoD's current strategic planning process ranging from its relationship to national strategic objectives to internal department performance management and improvement efforts.

LAI and MIT collaborative initiatives are partnering with the US Military Health System, in collaboration with the US Armed Services, to improve the health of military service personnel diagnosed with and being treated for psychological health difficulties. LAI will analyze the system's current state using quantitative and qualitative data and map enterprise-level decisions and their interactions and ultimately will help DoD architect a more effective and efficient enterprise for improving the psychological health of military service members and their families.

MIT Information Quality Program

The [MIT Information Quality Program](#) develops knowledge in the information quality field. Launched in 2002, MITIQ conducts research on all aspects of information quality, such as how to manage information as a product, how to develop an information product map, and how organizations adopt information quality over time.

In spring 2009, Richard Wang went on leave to become the US Army's chief data quality officer through an intergovernmental personnel act mobility program.

Under the leadership of the new director, professor Stuart Madnick, MITIQ has continued the MITIQ consortium and embarked on new initiatives such as potential collaboration with the Army, the Defense Intelligence Agency, and the financial services industry in addition to MITIQ's traditional sponsors.

Madnick and Yang Lee of Northeastern University, who are the founding co-editors-in-chief of the new Association of Computing Machinery *Journal of Data and Information Quality* (JDIQ), published the inaugural issue in spring 2009, ushering in a new era for the information quality field. JDIQ, along with many other initiatives in the information quality field, was a direct result of the activities of MITIQ.

In November 2009, MITIQ sponsored the 14th International Conference on Information Quality (ICIQ 2009) held overseas for the first time at the Hasso-Plattner Institut in Potsdam, Germany. ICIQ presents a forum for academic researchers and industry practitioners to exchange information quality knowledge and ideas. More than 150 participants from both academia and industry worldwide took part.

Another initiative of MITIQ was the establishment of the MIT Information Quality Industry Symposium, which was held at MIT and designed to bring together practitioners, vendors, and academics to address information quality issues. MITIQ sponsored the Third IQ Industry Symposium from July 15–17, 2009.

The MITIQ consortium has received sponsorship from Freddie Mac.

Systems Engineering Advancement Research Initiative

The [Systems Engineering Advancement Research Initiative](#) (SEArI) brings together a set of sponsored research projects and a consortium of systems engineering leaders from industry, government, and academia.

SEARi performs collaborative research to address advanced systems engineering challenges using theory-based and practice-based approaches to develop prescriptive research outcomes. The research group has a strong foundation in the space and aerospace system design and architecture domain, with more recent work branching into the transportation and infrastructure systems domain. Five areas of the research portfolio are socio-technical decision making, designing for value robustness, systems engineering economics, systems engineering in the enterprise, and systems engineering strategic guidance.

Several research projects were continued with government agencies in the US and Singapore and with the involvement of 14 graduate and five undergraduate students. SEARi continued its research effort under the MIT–Portugal Program.

SEARi held its annual research summit in October; sponsors from 12 government agencies and corporations attended.

One MIT Professional Short Course was held in June on architecting the future enterprise.

Twenty-five conference papers were presented at eight events, including two conference best paper awards.

SEARi authors Adam Ross, Donna Rhodes, and Daniel Hastings received the Outstanding Journal Paper of the Year award from the Wiley *Systems Engineering* journal.

Technology and Law Program

The **Technology and Law Program** (T&L) offers research opportunities and graduate-level courses that focus on the interface of law and technology, especially as it relates to sustainable development. T&L offers a two-semester sequence in environmental law and policy that is colisted in Engineering and Urban Studies. Law, Technology, and Public Policy—a core subject in the Technology and Policy Program—and Sustainability, Trade, and Environment are listed jointly with the School of Engineering and MIT Sloan School of Management. Originally part of the Cambridge–MIT Institute, the latter course continues to be offered at Cambridge University; it is also taught at the Harvard–Cyprus Institute of the Environment in Nicosia. A course in European and international environmental law is also taught at the Harvard–Cyprus Institute. As a result of the program, the MIT perspective on environmental law and sustainability has achieved international recognition.

Joel Moses

Acting Director, Center for Technology, Policy, and Industrial Development

Institute Professor

Professor of Computer Science and Engineering Systems

More information about the Center for Technology, Policy and Industrial Development can be at <http://web.mit.edu/ctpid/www/index.html>.

MIT Center for Transportation and Logistics

For more than 35 years, CTL has been a world leader in supply chain management, logistics, and transportation education and research. The Center's world-renowned research programs directly involve more than 47 faculty and research staff from a wide range of academic disciplines as well as researchers in various affiliate organizations around the world. In education, MIT is consistently ranked first among business programs in logistics and supply chain management.

Research

During the past academic year, many new research projects were added to the ones carried over from previous years on the CTL website. We had 140 active projects in FY2010. Major projects and initiatives are described below.

MIT Global SCALE Network

The MIT Global SCALE (supply chain and logistics excellence) Network continued to grow. As the only international alliance of leading research and education centers dedicated to the development of supply chain and logistics excellence through innovation, the SCALE Network promises to increase the Center's research and education reach and reputation. Currently, the SCALE Network spans North America, Latin America, and Europe; it consists of the CTL in Cambridge, MA; the Zaragoza Logistics Center (ZLC) in Zaragoza, Spain; and the Center for Latin-American Logistics Innovation (CLI) in Bogotá, Colombia. We continue to explore additional centers in China, India, and Panama.

Center for Latin American Logistics Innovation

In the two years since it was formed, CLI has launched multiple research projects, has established a regional network for academic collaboration, and has recruited leading companies as corporate strategic partners. The Center is cultivating deep relationships with top Latin American universities and institutions outside the region, including MIT CTL and ZLC.

CLI's flagship student program is the Graduate Certificate in Logistics and Supply Chain Management (GC-LOG), the most extensive non-formal education program of its kind in Latin America. The GC-LOG program started in July 2009. Offered by CLI and presented by MIT CTL faculty, the program's overarching goal is to train aspiring logistics and supply chain professionals in the region. The inaugural GC-LOG class was composed of 14 students from Brazil, Colombia, and Mexico. Seven applicants came from business schools and eight attended engineering programs. The students studied for three weeks in Bogotá before completing the certificate on the MIT campus in Boston in January 2010.

The second level of CLI's initiative in education is designed to "teach the teachers." This is achieved through a series of English-language academic workshops that take place twice a year at various venues in the region. The third workshop took place in August 2009 in São Paulo, Brazil, and focused on evaluating academic performance at the GC-LOG program. A core group of academic leaders worked on a 2011 marketing plan for CLI at this session as well. The fourth workshop, held in February 2010 in Panama, mainly focused on sharing research agendas across universities.

Also available at the faculty level are three-to-six-month visiting research fellow positions at MIT CTL. In the past two years, four faculty members have taken advantage of this program: two from Colombia, one from Chile, and one from Panama.

Corporate education represents the third layer of CLI's educational base, with a number of offerings at this level. Throughout the year, the Center organizes executive education conferences. The first one took place in February 2009 in Medellín, Colombia, and focused on demand management. There were some 400 participants, and a survey revealed that 99% of attendees were "satisfied/very satisfied" with the event. The second conference, on supply chain risk, attracted 250 attendees and scored similar results on satisfaction levels.

Companies can also attend LOGyCA's annual Leaders Summit to gain insights into the latest thinking in supply chain management. The inaugural conference took place in Bogotá in May 2009, and featured thought leaders from BrightStar Corporation, IBM, MIT, and ZLC.

The focus of the May 2010 summit in Bogotá was emerging markets. Business leaders from Asia, Africa, and Latin America gathered at the event to discuss how emerging countries can harness the competitive power of supply chains. The program of courses was launched in March 2009 in Bogotá with 13 participants. Again, satisfaction rates among the attendees were high, with 100% reporting that they were "satisfied/very satisfied" with the event. The second course, in September 2009, attracted 19 participants, including chief financial officers and chief operating officers.

The number of attendees at the executive education courses is trending upward, although attendance will be capped at around 30 to keep each class small. There will be two courses per year: the one in March will take place in Bogotá, and the September course will be located elsewhere in Latin America.

In addition to these various events for the business community, CLI plans to introduce an equivalent to the GC-LOG certificate for executives in 2010. This is part of a regional corporate educational program that is under development.

MIT-Zaragoza International Logistics Program

CTL has a multiyear partnership with the government of Aragón, Spain, to help create the leading European education and research program for logistics and supply chain management in its capital city of Zaragoza. MIT works with ZLC, a research institute associated with the University of Zaragoza, on research, graduate education, executive training, and outreach events for the international community. In recognition of CTL's role in establishing ZLC and the MIT-Zaragoza Program, the government of Aragón awarded MIT the Premio Aragón e Internacional Aragón 2009 to Yossi Sheffi on April 23, 2009.

The number of ZLC faculty expanded this year to 25, including full-time, adjunct, research staff, and ad honorem members from 15 countries who were trained at leading universities. Overall, the ZLC full-time staff consists of 44 people from 15 countries. In October 2009, ZLC moved to the PLAZA Logistics Park as planned to enhance interaction with companies operating there.

In 2010, the sixth class graduated from the MIT–Zaragoza international master’s degree program. The class of 2010 consisted of 31 students selected from more than 200 applicants. The MIT–Zaragoza doctoral program also grew to 10, with two additional students starting in fall 2010. The new PhD students will visit MIT in FY2011 to enhance their education. In addition, ZLC began offering a new executive education program with its partner institution INCAE. In summer 2010, ZLC is hosting its Third Summer Academy, which is organized jointly by the MIT–Zaragoza program at ZLC and the University of Bergamo. Past experiences were extremely productive with renowned professors such as Dr. Yehuda Bassok, Dr. Dorothee Honhon, Dr. Rogelio Oliva, and Dr. Nils Rudi. Students taking part in the course included those from IESE, Instituto de Empresa, HEC Paris, Hong Kong University of Science & Technology, and the University of Seville.

ZLC continued its leadership of the Spanish National Center of Excellence in Integrated Logistics (CNCLI) and its work on the singular strategic project for research in logistics. CNCLI played the coordination role for the national technology platform for integrated logistics, which engages industry and research institutes to define research and development priorities and action plans on strategically important issues for Spain’s future growth and competitiveness. The number of funded research projects continued to grow with new partners, such as the Bill & Melinda Gates Foundation, Medicos Sin Fronteras (Doctors Without Borders), the Transpirenaica Foundation, the Spanish Agency for International Development Cooperation, and the World Bank.

Due to the success of its 2008 and 2009 summits, ZLC is organizing its Third Global Health Supply Chain Summit on December 16–17, 2010, in Zaragoza. The MIT–Zaragoza Distinguished Speaker Series featured a large number of leading academics between July 2009 and June 2010.

Global Leaders in Environmental Assessment and Performance

CTL has developed a dynamic consortium of leading companies called Global LEAP—Leaders in Environmental Assessment and Performance. LEAP brings members together with top environmental and supply-chain experts to address their specific performance issues and plot solutions that strengthen both their companies and the environment. The outgrowth of our pioneering carbon-efficient supply chains project, LEAP offers an unprecedented opportunity for fact-driven and solution-oriented analysis of companies’ products and supply chains. It gives organizations the tools and information needed to measure their total environmental footprint, evaluate trade-offs, and shape a sustainable action plan.

NextLab

The MIT NextLab program works closely with industry partners worldwide to design and deploy mobile platforms that can catalyze new opportunities in the form of corporate innovation, the development of new business models, and the launch of new ventures in their verticals. These opportunities stem from disruption created by dramatic trends currently occurring in the mobile industry, including the exponential increase in cell-phone adoption of recent years, having surpassed 4 billion subscriptions worldwide, as well as the expanding footprint of the mobile signal to all corners of the planet. Leveraging expertise from across the Institute, the MIT NextLab program engages in research, teaching, development of mobile platforms, and on-site deployments worldwide.

Renewable Energy Delivery

The Renewable Energy Delivery project focuses on designing supply-chain systems for cost-effective renewable energy delivery to end consumers. The first key area is infrastructure design—optimizing the network to determine the size and location for generation and storage and the key links for transmission line expansion. System optimization models are being developed through a funded project with ACCIONA Energy, the world’s largest wind park developer. The second key area is dynamic grid management to enable growth of renewable generation. A paper based on a 2009 master’s thesis project addressing large-scale battery storage in the grid was accepted for the *Proceedings of the 2010 IEEE Power Engineering Society General Meeting*. An *MIT News* article in May 2010 on this battery storage paper has generated further interest in the research area. Finally, a paper on the overarching topic of renewable energy delivery was published in *Supply Chain Management Review* in January 2010.

Humanitarian Logistics

Some of the highlights from the past year include:

- A strategic partnership with the World Food Programme continues to feed much of the research agenda: direct interaction with its semiannual global training exercise to provide data for an MIT ESD PhD student, continued work with master’s students on a thesis project analyzing field operations in Ethiopia, and new projects with the logistics development team in areas such as planning tool development.
- Direct involvement with several partners (Partners in Health, US Agency for International Development, UN Office for the Coordination of Humanitarian Affairs) on a multisector assessment sponsored by the US military’s joint task force in Haiti. The assessment involved a survey of 288 displacement camps and neighborhoods in the country to determine needs after the January 2010 earthquake. A team of MIT graduate students from ESD, Sloan School of Management, and Tufts Fletcher School worked with MIT Lincoln Laboratory to support the analysis effort.
- A master’s thesis project with Partners in Health to enable this important nonprofit health care provider to scale up its supply chain in Haiti to support increasing health service offerings.

Logistics Clusters

The cluster project looks at the impact of logistics clusters around the world. It focuses on Singapore, Panama, Holland, Zaragoza, Memphis, and Alliance. The project looks to add to the emerging theory of logistics clusters in general and to develop insights into why logistics clusters work, the advantages of such clusters to members, how they form, and, most important, their impact on economic growth.

Supply Map Development

“Visualizing” the complex network of customers, suppliers, and locations that interact in global supply chains is not a simple feat. Multiple layers of geographic business information, usually fragmented within the organization, must be consolidated and shared to be able to create such a map. CTL has partnered with Media Lab researchers

to develop creative supply mapping technologies. The goal is to create a “canvas” that could be used by multiple supply-chain partners to overlay the basic structure of a supply chain. Once the supply-chain map is built, it can be updated in real time as information changes and can be used to measure a variety of supply-chain metrics (service, risk, or carbon footprint) in a seamless way.

MIT–Volpe Transportation Human Factors Research Program

The MIT–Volpe Transportation Human Factors research program was created in FY 2007 to initiate active research collaborations in several areas. The program has been awarded four projects: human factors pertaining to uncertainty and dynamic contradictions in air traffic flow management, professor Amedeo Odoni; locomotive cognitive alerter technology development and evaluation, Dr. Charles Oman; pilot computer model development and aircraft computer model integration, Dr. Charles Oman; and instrument procedures research, professor R. John Hansman.

Factors Influencing Operational and Economic Performance of the National Airspace System–Business Case Analysis

To support strategies for improving operational and economic performance of the National Airspace System and adjacent oceanic systems such as the North Atlantic and Pacific, it is important to understand the factors influencing transition in the system. In particular, it is essential to know the emergent factors that will influence the requirements for the system (demand) and the barriers to system transition (multistakeholder considerations).

Human Factor Recommendations for the Design of Instrument Procedures and Associated Charting

The goal of this effort is to develop human factor recommendations for the design of instrument procedures and associated charting to ensure that these procedures are usable, easily flyable, and not prone to pilot errors because of design characteristics that do not adequately account for human performance and limitations. These issues cut across four highly related perspectives: pilot perspectives (chart, procedures, and performance), air traffic control perspective (communications and procedures), flight deck automation and databases, and instrument procedure design.

Distributed Mechanisms for Determining National Airspace System–wide Service-Level Expectations

A prime NextGen objective is to move to a performance-based air traffic management system. Such a system should be capable of making intelligent trade-offs among different performance criteria when deciding on specific traffic flow management actions. Viewed at a high level, the objective of this research is to provide a means for the flight operator community to collectively set service-level expectations and thereby define the criteria for making the required performance trade-offs.

FreightLab

FreightLab continued research on a number of fronts, all related to freight transportation. Work has continued on the development of a transportation portfolio management tool for Wal-Mart stores. The resulting tool, called the freight network optimization tool (FNOT), determines the optimal allocation of different transportation resources on a freight network.

Future Freight Flows

Sponsored by the Transportation Research Board of the National Academies, this project examines how and where federal and state levels of government should invest in freight transportation infrastructure for the year 2040 and beyond. Utilizing scenario-planning techniques, the project team will work with shippers, carriers, third-party logistics, and government agencies at the federal, state, and local levels to create a more robust freight network.

New England University Transportation Center

In August 2006, the USDOT Research and Innovative Technology Administration named MIT as the lead university of the New England University Transportation Center. USDOT has extended the grant, and funding will continue beyond 2011.

In 2009, the New England University Transportation Center built a website and since then has launched a larger technology transfer program as mandated by the USDOT grant. This program includes a robust outreach program engaging researchers and transportation decision makers as well as greater use of social media and video tools to reach transportation stakeholders across the region.

The New England University Transportation Center research theme is the strategic management of disruptive change on transportation systems. This area of inquiry builds on research currently being done by the CTL AgeLab on aging and transportation—specifically, on the impact of disruptive demographics. Joseph Coughlin, founder of CTL's AgeLab, is also director of the New England University Transportation Center.

Partner universities of the New England University Transportation Center led by MIT include Harvard University and the state universities of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. Funding this year from the USDOT grant has enabled CTL to engage and fund research with colleagues in Computer Science and Artificial Intelligence Laboratory, Department of Urban Studies and Planning, and Civil Engineering.

AgeLab

AgeLab continues to grow and influence the expanding field of aging, technology, and innovation. Working with researchers across MIT—including Department of Urban Studies and Planning, Computer Science and Artificial Intelligence Laboratory, Brain and Cognitive Sciences, Microsystems Technology Laboratories, Aeronautics and Astronautics, and others—AgeLab has developed a robust research agenda that addresses transportation, health and wellness, and longevity planning.

In 2009, AgeLab completed reconstruction of its website, with expanded capability to engage sponsors, students, and researchers. It also launched a white paper series that serves as a platform for publishing works in process. An annual AgeLab symposium was kicked off to address transportation, health technologies, and business innovations for the older population. As AgeLab expands its work in consumer behavior, both in the laboratory and in the field, new industrial sponsors are joining to support the work, including Sanofi-Aventis, Pepsi, and others.

Evaluating the Seven Nonlinear Supply Chains

As part of the tailored supply chains project supported by Intel, Edgar Blanco and colleagues have identified the seven deadly supply-chain phenomena. They argue that this framework allows for a better understanding, and ultimately a better design, of supply chains. These phenomena are bullwhip effect, vulnerability, uncertainty, diseconomies of scale, congestion, waste, and self-interest. The current phase of the project refines, tests, and applies supply-chain simulation models and scenarios that measure and gauge the interaction of the seven supply-chain phenomena as well as traditional supply-chain metrics and designs.

CTL Outreach

CTL's outreach program works primarily with corporations to generate revenue in support of our research and outreach activities, establish relationships with a wide range of organizations that can serve as research collaborators and ready sources of real-world input, and foster rapid adoption of supply-chain management innovations developed by CTL.

The foundation of our corporate outreach is the supply-chain exchange, a nonresearch corporate membership program designed to foster interaction and networking—the “exchange” inherent in the name—among CTL researchers, our corporate members, and industry at large. We believe the exchange to be the largest and most active membership program in the supply-chain management field. Since mid-FY 2004, new exchange members have paid an annual fee of \$25,000. Membership in the exchange is a prerequisite to deeper interactions with CTL, including directed research projects, sponsorship of MLOG thesis projects, and membership in higher tiers of the outreach model (research partner and strategic partner). The current list of exchange members is available at http://ctl.mit.edu/partnering/list_partners.

Corporate Relations

The ongoing, two-part strategy that drives our outreach program is to increase the number of CTL's partner organizations via membership in the exchange program and to deepen our engagement with individual partners by growing their participation in our educational and research activities.

During FY 2010, four companies terminated their memberships in the exchange: AHRMM, Pfizer, Texas Instruments, and Unilever. In addition, 11 companies have gone on hiatus from active membership, reflecting ongoing economic and organizational disruptions related to the recession. We have continued to nurture our relationships with these companies and expect some of them to resume active membership in FY 2011.

Six partner companies were added to the program: Estafeta, GlaxoSmithKline, Manhattan Associates, Polo Ralph Lauren, Shire HGT, and Tyco Electronics. We are optimistic about growing our partner base during 2011, based on increased attendance at our events, increased member engagement in research activities, and especially a dramatic increase in executive education enrollment by member personnel.

Outreach Events

In FY 2010, CTL organized symposia, roundtables, workshops, conference sessions, and a research fest to achieve our varied outreach objectives. Additionally, CTL organized and hosted the first annual partners meeting, which convened key contacts from more than 20 of CTL's partner companies.

This year's CTL crossroads conference, which took place on March 25, 2010, focused on building supply chains that deliver sustainability. More than 180 executives convened on the campus of MIT for the sixth annual crossroads event this year to provide insights into the risks, opportunities, and emerging solutions to creating long-term sustainability. The proceedings are available to CTL partners via the CTL partner area on our website.

CTL held two sessions of its major supply-chain management executive education course during the year, January 5–8 and June 8–11, 2010. This four-day program for supply-chain executives and management teams, "Supply Chain Management: Driving Strategic Advantage," offers a combination of hands-on exercises and simulations, case studies, and highly interactive sessions developed by MIT for this unique course.

Both sessions of the executive course included a supply-chain risk simulation that is based on research conducted by CTL with a partner company over the past two years and represents unique and applied content that the course brings to the participants. The simulation was well-received in both sessions and will continue to be an element in future CTL executive education offerings.

This past year, CTL also conducted custom scenario-planning workshops on site at partner locations or at CTL, not only as part of a CTL research initiative but also as part of value delivery to CTL partners. Similarly, CTL offers open-enrollment executive workshops in strategy alignment as well as scenario planning.

On January 14, during Independent Activities Period, CTL successfully held its second annual networking night/poster session. The event gives master's students the opportunity to present their research projects in an informal setting to our corporate partners, faculty members, and invited guests, and it provides the corporate partners and our students the opportunity to network with one another in an informal setting. Students from the CTL SCALE Network programs (including MLOG, ZLOG, and GC-LOG) presented 70 thesis projects to 36 representatives from 23 companies. Attendees ranged from chief executive officer to human resources director to global supply-chain manager; companies that attended ranged from the Adidas Group to the Clinton Foundation.

On May 25–26, CTL invited members of the Center's supply-chain exchange to get an insider's look at the innovative research being done by students in CTL's MLOG program. During this day-and-a-half review, MLOG students presented their thesis projects, many of which have been sponsored by CTL partners.

Web Presence

The development of CTL's web presence and web communications strategy continues to evolve and expand. In FY 2010, the Center hired an outside firm to help with the

design of a new brand identity, brochure, and website and with the implementation of a new content management system. Of particular note is the new partner area, providing a portal through which partners can receive information on the Center, the latest publications and research, and online collaboration on topics of interest via a discussion board.

Personnel Changes

In FY 2010, new hires and appointments at the Center included Mark Colvin, MLOG academic administrator; Loïc Lagarde, research associate; Dr. Roberto Perez-Franco, postdoctoral associate; Jhonatan Rotberg, lecturer and technical associate; Kai Trepte, research associate; Dr. Ying Wang, postdoctoral associate; and Dr. Noel Watson, research associate. In addition, visitors to the Center included visiting military scholars Marc Sukolsky (civilian) and John Waller; international visiting scholars, Dr. Nicolas Bronfman, Dr. Zoila Guerra de Castillo, Dr. Edgar Gutierrez Franco, Dr. Hirotaka Osawa, Dr. María Jesús Sáenz, Dr. Juan Sanchez, Dr. Marco Serrato Garcia, and Dr. Karen Spens; international visiting students, Ana Barros, Oyvind Berle, Emilia Castro, Adrian Gasparini, Martin Lavallière, Mario Monsreal, Gerardo Pelayo Rubio, Eirini Spiliotopoulou, Christian Weller, Filippo Zampieri, Jun Laura Zhang, Philipp Osl, Zach Chuanzhong Tan, and Michele Vitagliano.

Departures from the Center included Ineke Dyer and Dr. Stephanie Jernigan.

Recognition

CTL's 2009–10 UPS fellowships were awarded to two outstanding students studying logistics, freight transportation, or supply-chain management. The winners were Christina Kim, SM fellowship, MLOG program, and Douglas Fearing, PhD fellowship, operations research.

Ahmedali Lokhandwala, working with Chris Caplice as his advisor, won the MLOG 2010 Outstanding Thesis Award for the following work: "Addressing Demand Variability in Transportation Planning Using Robust Planning Methodologies." AgeLab's Ying Wang won the best presentation award at the New England Chapter of the Human Factors and Ergonomics Society's 2009 Student Research Conference for her talk "Assessing the Validity of a Driving Simulation for Comparing In-Vehicle Informational Interfaces," November 13, 2009.

MIT's Next Billion Network, led by CTL's Jhonatan Rotberg, was selected for inclusion in the Design Triennial exhibition, organized by the Cooper-Hewitt, National Design Museum, Smithsonian Institution. The Next Billion Network is a striking example of socially beneficial mobile technologies that can meet the needs of low-income people in developing countries. The exhibition is on display through January 7, 2011.

Yossi Sheffi

Director, Engineering Systems Division

Director, MIT Center for Transportation and Logistics

Elisha Gray II Professor of Engineering Systems and Civil and Environmental Engineering

More information about the Center for Transportation & Logistics can be found at <http://ctl.mit.edu/>.