

Engineering Systems Division

The educational and research efforts of the [MIT Engineering Systems Division](#) (ESD) tackle substantial, 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 all five MIT schools.

More than 50 faculty members, holding dual or joint appointments within ESD and another MIT unit, are devoted to teaching and research in the field of engineering systems.

ESD awarded [170 degrees in AY2014](#) (ESD currently awards only graduate degrees). Academic programs include the ESD PhD program, the [ESD SM](#) program, Leaders for Global Operations (LGO), the MIT Supply Chain Management Program (SCM) (which awards the master of engineering in logistics degree), System Design and Management (SDM), and the [Technology and Policy Program](#) (TPP). More details about these master's programs are provided below.

Looking forward, ESD will morph into a larger entity that brings together the education and research in ESD, the Laboratory for Information and Decision Systems, and a new campus effort in statistics. The recommendation to form this new entity is the result of deliberations of four faculty committees led by Munther Dahleh and Karen Willcox (mission), Emery Brown and David Gamarnik (statistics), Anantha Chandrakasan and Alan Willsky (organizational structure), and Thomas Magnanti and Olivier de Weck (academic programs). The committees included 39 faculty members from all five MIT schools, with substantial participation from ESD faculty, and worked under the leadership of Professor Dahleh. The work of these committees built on that of three prior faculty committees: the Rivest committee, which focused on sociotechnical systems, and the Willcox and Sipser committees, which focused on statistics. Over the last two years, these seven committees have engaged many people from across the Institute. In May 2014, MIT provost Martin Schmidt sent out the committee's report to the MIT community for comment. Additional information about the status of this new entity is anticipated in August or September 2014.

Faculty

A full listing of ESD faculty can be found on the division's [website](#).

Munther Dahleh, professor of electrical engineering and computer science, is acting director of the Engineering Systems Division and director-designate of a potential new organization that would incorporate the people and programs of ESD, the Laboratory for Information and Decision Systems, a significant new initiative in statistics, and potentially other programs and entities.

Richard Larson, Mitsui professor of engineering systems, chaired the ESD Education Policy Committee and oversaw the division's PhD program, including admissions, in AY2014.

Research

ESD encompasses several major research programs, including the [Sociotechnical Systems Research Center \(SSRC\)](#), the [MIT Center for Transportation & Logistics \(CTL\)](#), the [Center for Biomedical Innovation \(CBI\)](#), the [Center for Engineering Systems Fundamentals \(CESF\)](#), and the [Center for Complex Engineering Systems \(CCES\) at KACST and MIT](#). These programs are described later in this report. Also, a number of ESD faculty and staff members are involved in the [MIT Portugal Program \(MPP\)](#). For more details, see the MPP report to the president.

Achievements

Below are some ESD faculty and teaching staff highlights for AY2014:

- Munther Dahleh was appointed to the William A. Coolidge Professorship (effective July 1, 2014).
- Jessika Trancik was named the Atlantic Richfield Career Development professor in energy studies (effective July 1, 2014).
- John Fernandez was promoted to full professor (effective July 1, 2014).
- David Simchi-Levi, Kris Johnson, and Alex Lee—along with online retailer Rue La La—received the 2014 Institute for Operations Research and the Management Sciences (INFORMS) Revenue Management and Pricing Section Practice Award.
- The Technology and Policy Student Society selected Richard Larson as a recipient of the TPP Faculty Appreciation Award.
- S. Joel Carlson and his advisor, Joseph Sussman, won the Ron Rice Award for Best Paper from the Canadian Transportation Research Forum.
- Joseph Sussman became the 30th recipient of the Transportation Research Forum’s Distinguished Researcher Award.
- Steve Eppinger was honored as a runner-up for the POMS (Production and Operations Management Society) Wickham Skinner Award for the best paper published in *Production and Operations Management* during 2013.
- [Dava Newman ran the Boston Marathon](#) as part of the [MIT Strong team](#).
- Sandy Pentland was inducted into the National Academy of Engineering.
- Cynthia Barnhart was named MIT chancellor.
- Noelle Selin was elected to the Global Young Academy.
- Eric von Hippel received a Humboldt Research Award honoring his research on user innovations and his work fostering international exchanges and scientific discussions around user innovation and open source innovation.
- James Utterback was named a fellow of the American Association for the Advancement of Science.
- Maria Yang was named a fellow of the American Society of Mechanical Engineers (ASME).

- Joseph Coughlin received the Partners Healthcare Connected Health Leadership Award for his innovative research in health technology and services to improve the lives of older adults.
- A project by co-principal investigators Stan Finkelstein and Richard Larson, as well as ESD PhD candidate Abigail Horn, was among the 11 selected to receive public health research awards.
- Stuart Madnick won the Merritt Williamson Award for Best Annual Conference Paper from the American Society for Engineering Management.
- Maria Yang and Dan Frey received Best Paper Awards at ASME conferences. Professor Yang received the Best Paper Award at the ASME Design Theory and Methodology Conference, *The Influence of Timing in Exploratory Prototyping and Other Activities in Design Projects*, while Professor Frey received the Best Paper Award at the International Conference on Advanced Vehicle Technologies for *“Conventional and Novel Methods for Estimating an Electric Vehicle’s ‘Distance to Empty.’”*
- Daniel Hastings was appointed to a three-year term (effective January 1, 2014) as director of the Singapore-MIT Alliance for Research and Technology (SMART).
- Donald Lessard, Vivek Sakhrani, and Roger Miller’s *“House of Project Complexity: Understanding Complexity in Large Infrastructure Projects”* won the Best Paper Award at the 2013 Engineering Project Organization Conference.
- Noelle Selin was selected as an Esther and Harold E. Edgerton Career Development professor.

Faculty Books

- [Sustainable Urban Metabolism](#), Paulo Ferrão and John E. Fernández (MIT Press, August 2013)
- [Social Physics: How Good Ideas Spread—The Lessons from a New Science](#), Alex Pentland (Penguin Press, January 2014)

Alumni Honors

Honors received by ESD PhD alumni (some in collaboration with ESD faculty/teaching staff) include the following:

- ESD PhD alumni Valerie Karplus and David Keith were hired as assistant professors at the MIT Sloan School of Management.
- ESD PhD alumni Don MacKenzie and Dave Keith and ESD PhD candidate Stephen Zoepf were recipients of the Barry D. McNutt Award at the 2013 Transportation Research Board annual meeting. They received the award for their paper *“Charging Choices and Fuel Displacement in a Large-scale Plug-in Hybrid Electric Vehicle Demonstration.”*

- The National Science Foundation (NSF) recently created a [short video](#) highlighting the work that [Cambrian Innovation](#) has done with its support. Dr. Matthew Silver, an ESD PhD alum, is the founder and CEO of Cambrian Innovation.
- ESD PhD and TPP alumna Erica Fuchs was named a “[Top 40 under 40 Young Scientist](#)” by the World Economic Forum and the InterAcademy Panel on International Issues.
- ESD PhD alum Matthew Bunn was promoted to professor of the practice at the Harvard Kennedy School (effective July 2013).

Student Honors

Below are some of the honors received by ESD PhD students:

- A team from professor Marta Gonzalez’s [Human Mobility and Networks \(HuMNet\) Lab](#), including ESD PhD candidate Jameson Toole, won first place in the prediction category of the MIT Big Data Challenge. Toole also won second place with his scientific visualization of one week of taxi pickups and drop-offs. In addition, a team including Nathan Perkins (TPP ’11) and Tommy Leung (ESD PhD candidate) finished seventh in the challenge (out of 25 finalists and more than 200 teams).
- ESD PhD candidate Jonathan Kronos was awarded a [Schmidt-MacArthur Fellowship](#).
- ESD PhD candidate Sahar Hashmi, MD, presented a poster (“Innovative Integrated Systems Design of Diabetes Care and Management Model”) at the Innovations in Health Care Conference at MIT that was selected as a runner-up for best student poster presentation.
- Tina Srivastava, an ESD PhD student, SDM alum, and research assistant for SSRC’s [Post-Traumatic Stress Innovations project](#), received the [Technical Innovation-Industry Award](#) at the 2013 Women of Color STEM Conference in October in Dallas. (She is now an interdepartmental PhD student, with ESD as her home department.)
- ESD PhD student Ross Collins won the [2013 Global Energy Essay Contest](#), held for students worldwide by the United Nations.
- ESD PhD student Alexandre Jacquillat won the 2013 Best Student Presentation Award from the INFORMS Aviation Applications Section. Jacquillat also received the 2013 Anna Valicek Award for Best Student Paper from the Airline Group of the International Federation of Operations Research Societies.
- ESD PhD candidate Vivek Sakhrani won a Best Poster award at the 2013 conference of the Engineering Project Organization Society for “Modeling the Technical and Contractual Tradespace of Large Desalination Projects.” Also, Sakhrani was awarded a Tata Fellowship (2013–2014) to study infrastructure public-private partnerships in India. His work in this area is supervised by Richard de Neufville and Donald Lessard.

Major Meetings

ESD Alumni Advisory Council

The ESD Alumni Advisory Council did not meet during AY2014 but is slated to meet in October. Alumni Advisory Council member Don Shobry is the new president of the [MIT Alumni Association](#).

Council for Engineering Systems Universities

The [4th International Engineering Systems Symposium](#) was held in June at the Stevens Institute of Technology.

Systems Safety

Professor Nancy Leveson and her students held a [three-day workshop](#) in spring 2014 on their new system safety and security approaches based on systems theory. More than 240 people from 20 countries attended.

Munther Dahleh

Acting Director, Engineering Systems Division
Interim Director, Laboratory for Information and Decision Systems
Professor of Electrical Engineering and Computer Science

Leaders for Global Operations

The MIT [Leaders for Global Operations](#) (LGO) program, now in its 26th year, is a partnership of the MIT Sloan School of Management, the MIT School of Engineering, and major companies that support the program's commitment to excellence in manufacturing and operations. LGO offers an MBA or an SM from the Sloan School of Management and an SM from the School of Engineering.

Governance

LGO is run by a governing board of senior officers from the managing partner companies, program co-directors, and MIT deans and is co-chaired by Jeff Wilke (LGO '93) of Amazon.com and Mick Maurer of United Technologies–Sikorsky. The operating committee, chaired by industry co-director Vah Erdekian, handles ongoing program management.

New Leadership

Thomas Roemer was appointed as [LGO's new executive director](#) effective July 1, 2014. He succeeds Don Rosenfield, who is retiring from his role as LGO's founding program director.

Admissions

Fifty new students in the LGO class of 2016 matriculated and began an intensive summer session in June. The class has an average of five years of work experience. The entering class, broken down by engineering discipline, is as follows:

- Aeronautics and Astronautics: 5
- Biological Engineering: 1
- Chemical Engineering: 1
- Civil and Environmental Engineering: 1
- Electrical Engineering and Computer Science: 3
- Engineering Systems Division: 25
- Mechanical Engineering: 14

LGO received 301 applications (up from 297 the previous year), and 86% of admitted candidates accepted a place in the program.

Internships and Research

The LGO class of 2014 had 48 graduates in June. Each graduate completed a six-month internship at a partner company, leading to a master's thesis. The 2014 class had international internships in locations including Costa Rica, Peru, Chile, Ireland, Germany, Spain, and Switzerland. A number of follow-on internships from work done by the LGO class of 2013 were handed off to members of the 2014 class.

China Leaders for Global Operations

Students from [China Leaders for Global Operations](#), LGO's sister program at Shanghai Jiao Tong University, [visited MIT in July 2013](#).

Plant Tours

Local plant tours took place in summer 2013 at Amgen, National Grid, Raytheon, Sanofi/Genzyme, Sutton and Millbury, United Technologies Corporation–Kidde Fenwal, and Verizon Wireless. Students on the annual two-week [domestic plant trek](#) in January 2014 visited General Motors in Michigan, Nike in Oregon, Boeing in Washington, Amazon in California, Raytheon in Arizona, Dell in Texas, and Amgen in Puerto Rico. The [international plant trek](#) in March visited China and Korea, with tours at partner companies LG Electronics and GM Korea in Seoul and Caterpillar and SanDisk, as well as Pegatron and Compal (suppliers for partner company Dell), in Shanghai.

Alumni

There were two major events for alumni in the past year: the annual [alumni conference](#) in San Francisco and “[DonFest](#),” a gala in honor of retiring program director Don Rosenfield that drew hundreds of LGO alumni for a conference and celebration at Fenway Park in May.

Aaron Raphel (LGO '06) continues as the official alumni voice on the LGO operating committee. MIT faculty as well as LGO and SDM alumni continued to present periodic webcasts. An alumni advisory board headed by Kristin Toth Smith (LGO '03) continues to oversee fundraising, the annual conference, operating committee representation, and networking events.

Through an organized fundraising effort, alumni contribute to three funds: the William C. Hanson, Don W. Davis, and Jan Klein Leadership Fund; the Alumni Annual Fund; and the Endowed Discretionary Fund. Portions of the funds were used for immediate needs and were distributed to support student scholarships and plant tour expenses. The alumni fundraising total was approximately \$94,000.

To date, 67% of the students in the class of 2014 have accepted positions in manufacturing and operations companies; 44% of these positions are at LGO partner companies.

Global Operations Leadership Seminars

LGO students attend weekly on-campus seminars with faculty and industry experts to explore local, national, and international manufacturing, leadership, and business issues. The 13 speakers in fall 2013 and spring 2014 included Richard Dauch (LGO '92), CEO of Accuride; Charlie Hix (LGO '98), director of Boeing's Propulsion South Carolina; Dave Limp, vice president of Amazon Kindle; Gary Loveman, CEO of Caesars Entertainment Corporation; Dave McMullin, vice president, supply chain, Novartis; Bill Rich, vice president, external supply, Amgen; Tanja Vainio (LGO '04), CEO and country manager, ABB Hungary; and Larry Zahner, general manager of manufacturing at General Motors.

New Partners

An active student, staff, and company committee has brought new partners to LGO. Boston Scientific, Danaher, Li & Fung, Pacific Gas & Electric, and Pfizer have joined in the past year, and other companies are in discussions to join the partnership in the coming year.

Awards

The Leaders for Global Operations program received the prestigious [UPS George D. Smith Prize](#) from INFORMS. The prize is awarded to an academic department or program for effective and innovative preparation of students to be good practitioners of operations research.

Other awards presented to LGO community members include the following:

- Scott Bromley and Alex Whigham (both LGO '15) were co-winners of LGO's [Charles Harrison Smith III Memorial Award](#).
- Sean Whipple (LGO '14) won the LGO [Best Thesis Award](#).
- Jerry Chiang (LGO '14) was named a [Siebel Scholar](#).
- Two LGO students were members of award-winning teams: Albert Chan (LGO '15) and his Unified Solar teammates won both top awards in MIT's annual [Clean Energy Prize](#) contest, and Greg Price (LGO '14) and his Aldatu Biosciences teammates won in the Health and Science category of the 2014 [Harvard Deans' Health and Life Sciences Challenge](#).

- LGO faculty co-director Georgia Perakis, the William Pounds professor of management, won the [Jamieson Prize for Excellence in Teaching](#). Perakis was also named to the advisory committee for the MIT Innovation Initiative.
- Leigh Hafrey, senior lecturer in communications and ethics, was named [MIT Sloan’s Teacher of the Year](#).
- Josh Jacobs, director of operations and partner integration, and Leah Schouten, admissions and career development coordinator, [won MIT Infinite Mile Awards](#).
- Associate professor of operations management Retsef Levi and colleagues won the [Daniel H. Wagner Prize for Excellence in Operations Research Practice](#) for their paper “Matching Supply and Demand via Delayed 2-Phase Distribution at Yedioth Group—Models, Algorithms and IT.”
- A team including assistant professor of operations management Itai Ashlagi was one of [six finalists for the INFORMS Franz Edelman Award](#) for Achievement in Operations Research and the Management Sciences. Ashlagi also won the [INFORMS 2013 Public Programs, Services and Needs Best Paper Award](#) for “Optimal Allocation of Public Services without Monetary Transfers or Costly Signals.”

Georgia Perakis
Management Co-director
William F. Pounds Professor of Operations Research

David Simchi-Levi
Engineering Co-director
Professor of Civil and Environmental Engineering and Engineering Systems

Vah Erdekian
Industry Co-director

Thomas Roemer
Executive Director, LGO Program

System Design and Management

FY2014 was a year of intensive work focused on developing [System Design and Management’s](#) (SDM) new curriculum. This effort, which resulted in an integrated core, was led by professor Olivier de Weck and a team including Bryan Moser, Qi Van Eikema Hommes, Matt Kressy, Bruce Cameron, Steven Eppinger, Warren Seering, Joan Rubin, and Pat Hale. Two classes were admitted: one that matriculated in January 2014 and another that will start in August 2014. The new start date will enable SDM fellows to matriculate with the majority of on-campus MIT students and afford them more opportunity to become engaged in the wide spectrum of MIT activities that begin in the fall. They will take the new core with students in the SDM certificate program, which will enable sponsoring companies multiple pathways to develop systems thinking capability in their organizations. A new track specializing in product design and

management, which will be led by Matt Kressy, also went into development and will begin in fall 2016.

Program Communications, Marketing, and Corporate Sponsorship

As a way to recruit prospective students for SDM's classes of 2014 and 2015, the program held several live information evenings for local MIT alumni and others interested in SDM. SDM also offered its first live virtual information session, which was attended by more than 100 prospective students from around the world and is now available on demand at the program's [website](#). Additionally, the program continued the MIT SDM Systems Thinking Webinar Series, which has had several thousand registrants and on-demand viewers since its inception in November 2010. SDM also hosted close to 300 attendees at its annual conference in October 2013.

Distance Learning

Significant upgrades continue to be made to our distance delivery capabilities. WebEx is now the standard delivery mechanism, and we have decreased the number of distance offerings to the SDM core.

Master of Engineering Management Programs Consortium

The Master of Engineering Management Programs Consortium continues to provide benefits through sharing of best practices in admissions, program content and administration, and alumni support. A new regional group was initiated in Washington, DC, joining the existing groups in Boston, New York City, and Chicago. Over 160 alumni have become members of the consortium's alumni group, and more than 30% participated in the spring national leadership meeting and alumni networking event.

Student Statistics

In January 2014, the majority of SDM students were either members of the military (who joined in summer 2013) or Singapore University of Technology and Design (SUTD) students, who have a limited amount of time (13 months) to complete their program. This group was limited to 41 students instead of the usual 55 to 65. The decision was made to shift the SDM start date to the fall in 2014–2015.

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

The MIT Graduate Certificate Program in Systems and Product Development is now in its 14th year. Company sponsors have included John Deere, Lawrence Livermore National Laboratory, Cummins, Boeing, United Technologies Corporation, Draper Laboratory, Instrumentation Laboratory, and Biomerieux, among others. John Deere has sponsored more than 100 students through either the master's or certificate program.

Student Awards

Stephanie Goerges (SDM '11) of Cummins Engines won the SDM Best Thesis Award for "System Theoretic Approach for Determining Causal Factors of Quality Loss in Complex System Design." Steven "Sid" Osgood (SDM '13) of the US Coast Guard was a finalist.

Wilfredo “Alex” Sanchez (SDM ’13) received the MIT SDM Student Award for Leadership, Innovation, and Systems Thinking. Finalists included Suzanne Livingston and Marianna Novellino (both SDM ’13).

Staffing

Lesley Perrera joined the SDM staff as admissions coordinator and Erik Ferris as IT/web specialist (shared with ESD and LGO).

Steven Eppinger

Co-director

General Motors Leaders for Global Operations Professor of Management Science

Professor of Engineering Systems

Warren Seering

Co-director

Weber-Shaughness Professor of Mechanical Engineering

Professor of Engineering Systems

Joan Rubin

SDM Industry Co-director

Patrick Hale

Executive Director, SDM Program

Technology and Policy Program

The [Technology and Policy Program](#) is an interdisciplinary graduate program focusing on issues at the interface of technology, society, and the sociotechnical aspects of complex systems. In AY2014, 38 students graduated with an SM in technology and policy. Approximately 20% of these students will pursue a doctoral degree following the completion of their SM. Other graduates take jobs in industry, government service, start-ups, or consulting.

Research

This year a few TPP students funded at least one term with teaching assistantships. Many TPP students are affiliated with the MIT Energy Initiative (MITEI), where they study the challenges of energy choices, sustainability policy, and environmental responsibility. TPP students also conduct research for many other labs and centers across the campus, including the Tata Center for Technology and Design, the Joint Program on the Science and Policy of Global Change, the Center for Energy and Environmental Policy Research, the Computer Science and Artificial Intelligence Laboratory (CSAIL), and a number of research initiatives connected with ESD such as the Lean Advancement Initiative, the Sociotechnical Systems Research Center, and the Center for Biomedical Innovation.

TPP faculty continue to lead the MIT Portugal Program in bioengineering systems, sustainable energy and transportation, and design-inspired products, and many TPP students pursue collaborative international research projects in engineering systems as part of MPP. TPP students also work with MIT and Singapore University of Technology and Design faculty in the development of new curricula for SUTD and, in particular, the International Design Centre.

Fellowships

TPP students received several MIT fellowships, including the Legatum, Lemelson Presidential, Collamore-Rogers, MITEI, Tata, and Lincoln Laboratory fellowships as well as the Office of the Dean for Graduate Education Diversity Fellowship. External fellowships awarded to TPP students included fellowships from NSF, the Gates Millennium Scholars Program, the **Natural Sciences and Engineering Research Council** of Canada, the Fulbright Program, and Hertz in addition to fellowships from Japan, Qatar, Chile, Mexico, Turkey, and Singapore.

Policy Internship Program

Sixteen TPP students representing five countries traveled to Washington, DC, in March. TPP alumni arranged and hosted presentations at the National Aeronautics and Space Administration, the World Bank, SRI International, the Science and Technology Policy Institute, Third Way, the US Department of Energy, the office of US congressman Alan Lowenthal of California, and the Environmental Protection Agency. During the trip, TPP hosted a networking reception for students and alumni.

In summer 2014, TPP funding will support students participating in unpaid internship programs at the International Telecommunication Union (Geneva), the United Nations (New York), the Organisation for Economic Co-operation and Development (Paris), Shell (China), and the Institute for Research in Technology (Spain). In addition, other TPP students are pursuing paid technology policy internships in the United States and abroad or have received funding from the MIT International Science and Technology Initiatives (MISTI), or the MIT Public Service Center.

Conferences and Workshops

This year's meeting of the Technology Management and Policy Graduate Consortium, held in June, was hosted by IST in Lisbon, Portugal. More than 40 students and faculty from nine universities participated in the event. TPP student Michael Davidson received the award for the best presentation by a master's student. Through the generosity of a private donor, TPP was able to provide travel funds for six TPP and ESD PhD students and two young ESD researchers.

The annual MIT Energy Conference and MIT Energy Night leadership teams featured several TPP students. Our students are involved in leadership of a number of organizations and initiatives across the Institute, including the MIT Energy Club, the MIT Clean Energy Prize, the Science Policy Initiative, Stand with Science, Graduate Women at MIT, LBGT@MIT, MIT house committees, and the Transportation Club.

Student Honors and Awards

TPP students received honors and awards from MIT and beyond. This year, students received MIT Student Leader Awards, placed third in the student case competition at the International Association for Energy Economics conference, and won the Hydro Research Foundation research award. Graduating student Zak Accuardi received Best TPP Thesis honors for his work with John Fernandez.

Student Society

Among this year's highlights were the "Culture Nights" and the iAmbassador series, which offer international students an opportunity to give presentations about their culture and technology policy issues in their home countries. In April, the student society organized an alumni panel discussion and TPP alumni-student mixer.

Alumni Engagement

With more than 1,100 alumni, TPP continues to foster a strong alumni community. Alumni support student and program initiatives, including funding for summer internships, recruitment and outreach, and support for women in technology and policy.

Dava Newman

Director

Professor of Aeronautics and Astronautics and Engineering Systems

MIT Sociotechnical Systems Research Center

The [MIT Sociotechnical Systems Research Center](#) (SSRC) is an interdisciplinary research center that seeks collaborative, holistic, systems-based approaches to complex sociotechnical challenges. SSRC comprises nine research programs, and its total research volume in FY2014 was approximately \$11 million. Details on [SSRC's partners](#) are provided below.

Consortium for Engineering Program Excellence

The [Consortium for Engineering Program Excellence](#) (CEPE) focuses on improving program performance by bridging the intersections between program management, systems engineering and product development, lean management, and organizational change. Its strategic partners are the Project Management Institute (PMI) and the International Council on Systems Engineering.

CEPE presented findings from its study on the integration of program management and systems engineering at the PMI Global Congress in New Orleans (October 2013) and the PMI Global Congress EMEA in Dubai (May 2014).

CEPE completed a global survey on the application of agility principles to program management, and several publications based on this significant new data set are currently in process.

During this period 10 master's theses were completed, resulting in four presentations at the 12th Annual Conference on Systems Engineering Research in March in Los Angeles and two presentations at the DESIGN 2014 conference in May in Dubrovnik, Croatia. Additional publications are under way based on the research associated with these theses.

Professor Warren Seering is CEPE principal investigator, and Dr. Eric Rebentisch is research lead.

Ford-MIT Alliance

The [Ford-MIT Alliance](#), an Institute-wide initiative, was established in 1998. In 2013 the alliance, which is the Institute's longest running large-scale collaboration with industry, began a fourth phase that will renew automatically each year for the foreseeable future. Since 1998, the alliance has funded more than 150 projects across the Institute, with a total investment to date by Ford of more than \$48 million.

The Ford-MIT Alliance research portfolio is managed by an operating committee that includes the initiative's co-directors, professor Jonathan How and Ed Krause, Ford's global manager for external alliances, research, and advanced engineering. This group reports to an executive committee that includes Martin Schmidt, associate provost and professor of electrical engineering at MIT, and Paul Mascarenas, Ford CTO and vice president, Research and Innovation. The alliance holds executive committee meetings on campus twice per year.

MIT Information Quality Program

During the year, the [MIT Information Quality Program](#) (MITIQ) and SSRC sponsored the 3rd Annual Chief Data Officer Forum and the 7th Annual Chief Data Officer and Information Quality Symposium. Both events focus on information quality and data science. Dr. Rich Wang is MITIQ director. Professors Stuart Madnick and Yang Lee continue to edit the *ACM Journal of Data and Information Quality*.

Materials Systems Laboratory

Professor Joel Clark is the faculty director of the [Materials Systems Laboratory](#), Richard Roth is the lab's director, and Dr. Randolph Kirchain (ESD PhD) is the principal research scientist. A list of [current projects](#) and [recent publications](#) is available on the lab's website.

Project Health

Within [Project Health](#), the [MIT Post-Traumatic Stress Innovations \(PTSI\)](#) project is using social science methodologies and strategic analysis of organizations to examine the continuum of care for service members and their families affected by post-traumatic stress.

Also, MIT, along with six other universities, is a member of a [partnership with the United States Agency for International Development](#) to help alleviate poverty in the developing world through the use of science and technology.

Systems Engineering Advancement Research Initiative

The [Systems Engineering Advancement Research Initiative](#) (SEArI) leads MIT's continuing participation in the US Department of Defense (DOD) University Affiliated Research Center (UARC) and the Systems Engineering Research Center (SERC). Also, SEArI collaborates with other universities involved in the SERC research program, including Georgia Tech, the University of Southern California, the University of Virginia, and Pennsylvania State University. Several research projects continued with government agencies in the United States and Singapore, as well as with the Naval Postgraduate School and NTNU (Norwegian University of Science and Technology). A four-year collaboration project with a Singapore government agency was completed in March. Eleven graduate students (both master's and doctoral level) from several degree programs and one visiting graduate student performed research with the group. SEArI's fifth summer project engaged five undergraduate students in systems engineering research.

The SEArI team published and presented nine conference papers, published three journal papers, and presented three invited talks. SEArI was awarded one of two large five-year research projects funded by DOD's systems engineering UARC.

Deborah Nightingale

Director, Sociotechnical Systems Research Center

Professor of the Practice of Aeronautics and Astronautics and Engineering Systems

Center for Biomedical Innovation

The [Center for Biomedical Innovation](#) integrates high-impact collaborative efforts across the MIT campus, as well as with external stakeholders, from the global biomedical and health care innovation ecosystem. The size and diversity of its ecosystem of collaborators continues to grow.

Biomanufacturing Program

The [Biomanufacturing Program](#) (BioMAN) leverages the expertise of MIT faculty across multiple disciplines; research focus areas include new analytical tools for improving quality and consistency during manufacturing, micro-scale manufacturing platforms, and regulatory science. In July 2013 BioMAN hosted a workshop, "Cell Engineering and Biopharmaceutical Manufacturing," that introduced cutting-edge science and tools pursued by faculty and reviewed the current challenges facing the industry.

In October 2013, BioMAN and the Global Biological Standards Institute co-hosted the [Biotechnology & Standards Conference: The Prospects for a Life Sciences Revolution](#), which focused on identifying key opportunities for standards in life sciences research and encouraging more systemic evaluation of the role that standards play in innovation, research, and manufacturing productivity. MIT faculty members Scott Stern, Pierre Azoulay, Fiona Murray, and Ron Weiss participated and shared their research with an audience of academics, practitioners, and policymakers.

Consortium on Adventitious Agent Contamination in Biomanufacturing

In 2013, six companies joined the [Consortium on Adventitious Agent Contamination in Biomanufacturing](#) (CAACB), bringing its membership to 23 companies. CAACB has continued to collect biopharmaceutical industry data around virus contaminations. The project's results have been presented at multiple scientific conferences and are expected to be published early next year. CAACB has also begun two new collaborative research projects. These projects focus on evaluation of media treatment technologies for use in biopharmaceutical manufacturing and risk assessment and risk control of virus contaminations in biomanufacturing. CAACB continues to host workshops addressing specific adventitious agent contamination topics; one workshop was held in December 2013, and another is scheduled for July 2014.

NEW Drug Development ParaDIGMS

The mission of [NEW Drug Development ParaDIGMS](#) (NEWDIGS) is to more reliably and sustainably deliver new, better, affordable therapeutics to the right patients faster. NEWDIGS quarterly workshops brought together senior global leaders from the pharmaceutical industry, regulators, payers, academia, and patient organizations to discuss the design and implementation of relevant system-level innovations. The European Medicines Agency, a long-standing NEWDIGS collaborator and co-host of a major 2014 workshop, launched the world's first [pilot project on adaptive licensing](#) in March 2014. This important evolution in pharmaceutical regulation is a compelling illustration of an emerging role for academia in catalyzing collaborative, research-driven policy change.

This year NEWDIGS launched two key research initiatives designed to support the implementation phase of adaptive licensing: development of an open access multistakeholder simulation platform and evaluation and enhancement of real-world data systems within and across regional jurisdictions.

In July 2014 NEWDIGS co-hosted (with professor Andrew Lo's Laboratory for Financial Engineering and the National Organization for Rare Disorders) an invitational workshop, *The Next Act: What's Needed to Make Orphan Drugs Readily Available to People with Rare Diseases*.

Sponsored Research Projects

MIT has received \$2.6 million from the Food and Drug Administration (FDA) in support of a three-year project focused on multiple integrated conceptual and technical research efforts that seek to enhance the capability of FDA's Office of International Programs to design and implement technical solutions that will better predict, assess, and proactively mitigate risks related to adulterated food and drug products originating in China. The project is a collaboration involving faculty, staff, and students from MIT Sloan, CSAIL, and CBI.

CBI's Biomanufacturing Research Program completed the first year of a \$10.4 million project to further the Defense Advanced Research Projects Agency (DARPA) Biologically-derived Medicines on Demand program. The program made significant progress toward developing innovative methodologies for engineering robust, flexible

microbial strains capable of synthesizing multiple protein therapeutics, as well as flexible purification processes and novel analytical technologies capable of real-time testing and feedback. MIT faculty involved in this program include professors J. Christopher Love (principal investigator) and Michael Strano from the Department of Chemical Engineering, professor Anthony J. Sinskey from the Biology Department, and professors Rajeev Ram, Jongyoon Han, and Tim Lu from the Department of Electrical Engineering and Computer Science (EECS). This multi-institutional collaboration also involves the Barnett Institute at Northeastern University, the Rensselaer Polytechnic Institute, the Pall Corporation, and PerkinElmer.

Educational Activities

The Amgen Foundation has provided a \$388,066 grant to develop the Amgen-MIT Biomanufacturing Educational Initiative, which is focused on manufacturing of biologics. This initiative aims to highlight the complexity and importance of biologics manufacturing, increase undergraduates' exposure to the field, and encourage students around the world to consider careers in the pursuit of manufacturing life-saving biologic medications. A new course, 10.03x Making Biologic Medicines for Patients: The Principles of Biopharmaceutical Manufacturing, will be on the edX platform, and this class will teach undergraduate students about the manufacturing of large, complex biologic medicines (e.g., monoclonal antibodies) for the treatment of diseases such as rheumatoid arthritis and cancer.

The 10.03/10.53 Advances in Biomanufacturing course, led by Professor Love, Professor Sinskey, and Dr. Stacy Springs, focused on how biopharmaceutical therapeutics are manufactured and delivered. The class also provided students with the opportunity to meet and interact with guest lecturers such as MIT professor Rajeev Ram and Dr. Jeff Baker (deputy director, Office of Biotechnology Products, FDA Center for Drug Evaluation and Research), as well as subject matter experts from Biogen Idec, Sanofi Pasteur, Genzyme, Merrimack Pharmaceuticals, and GE Healthcare.

CBI Community

Current participants in CBI's research and educational activities include the following.

Industry

Aetna
 Amgen
 Aquafine BioProcess
 Asahi Kasei
 Baxter
 Biogen Idec
 BioMarin
 Boehringer Ingelheim
 Bristol-Myers Squibb
 Eli Lilly
 EMD Millipore
 Genentech
 Genzyme

GlaxoSmithKline
 Histogenics
 Johnson & Johnson
 KEW Group
 Latham BioPharm Group
 LFB Biotechnologies
 Life Technologies
 MedImmune
 Merrimack Pharmaceuticals
 Metabolix
 Millennium Pharmaceuticals
 Novartis Pharma AG
 Novartis Vaccines & Diagnostics
 Pall Corporation
 PerkinElmer
 Pfizer
 Sanofi
 Sanofi Pasteur
 Shire
 Sigma-Aldrich Fine Chemicals

Government Agencies

Centers for Disease Control and Prevention
 Defense Advanced Research Projects Agency
 European Medicines Agency
 Health Canada
 National Institute of Standards and Technology
 National Institutes of Health
 Singapore Health Sciences Authority
 UK Medicines and Healthcare Products Regulatory Agency
 UK National Institute for Health and Care Excellence
 US Food and Drug Administration

Academia (including teaching hospitals)

MIT (School of Science, School of Engineering, Sloan School of Management, and School of Humanities, Arts, and Social Sciences)
 Georgetown University
 Harvard Medical School
 Massachusetts General Hospital
 Memorial Sloan Kettering Cancer Center
 National University of Singapore
 Northeastern University
 Rensselaer Polytechnic Institute
 University of Prince Edward Island

Other

Alfred P. Sloan Foundation
 European Federation of Pharmaceutical Industries and Associations
 Friends of Cancer Research
 Genetics Alliance
 Innovative Medicine Initiative

Paula (Gigi) Hirsch

Executive Director, Center for Biomedical Innovation

Center for Complex Engineering Systems

The Center for Complex Engineering Systems (CCES) is based jointly at MIT and the King Abdulaziz City for Science and Technology (KACST), Saudi Arabia's national science agency. It is part of KACST's Joint Centers of Excellence Program (JCEP).

CCES's third full year of operations marked several significant milestones in the center's growth and impact. With the introduction of four new research projects, the range of intellectual inquiry continues to expand, capitalizing on the dynamic range of possibilities afforded by a complex engineering systems approach. These new projects focus on solar water desalination, labor market dynamics, urban mobility patterns, and the impact of infrastructure investment strategies on inclusive wealth. Our number of affiliates has grown significantly in both Cambridge and Riyadh, and the number of affiliated students and researchers continues to provide new opportunities for mentorship, collaboration, and academic achievement.

The capstone accomplishment for CCES is this year's opening of new research facilities at both MIT and KACST. In addition to combining administrative offices and work spaces for permanent and visiting researchers, the center's Collaborative Design Laboratory is the intellectual home for research and creativity at CCES. The design laboratories at both CCES facilities are dynamically outfitted for a multiplicity of uses, including modeling and simulation, serious gaming, multi-stakeholder negotiations, and immersive visualizations.

Affiliations and Collaborations

We have expanded our roster of affiliates within the Institute to nearly 60 people from a broad range of MIT departments, labs, and centers, including the Departments of Architecture, Civil and Environmental Engineering, Electrical Engineering and Computer Science, and Earth, Atmospheric and Planetary Sciences, as well as several research centers, programs, and MIT Media Lab groups. Each CCES research project team is composed of professors, research scientists, postdocs, and graduate students based at MIT and a corresponding number of research team members and principal investigators based at KACST, all of whom hold research affiliate status at MIT. The number of KACST-based affiliates has grown to about 20, including a cohort of young researchers selected from the top 1% of applicants to the JCEP Advanced Training Program, whose goal is to promote the intellectual and professional development of the next generation of technology leaders and systems thinkers in the kingdom.

Over the past year, CCES has expanded its network of relationships with stakeholders to more than 20 organizations, including the Ministries of Labor, Economy and Planning, and Water and Electricity and the Arriyadh Development Authority. These relationships are further enhanced by collaboration with leaders from other institutions of higher education in Saudi Arabia such as the King Abdullah University of Science and Technology, King Saud University, and the King Fahad University of Petroleum and Minerals.

We have begun to explore our first collaborations with industry partners, in particular with Boeing, which has a co-located facility with CCES at KACST in Riyadh. We hope to build upon our relationship with Boeing and other third-party sponsors in the future.

Workshops

In 2014, CCES held four workshops for all researchers and collaborators associated with the center's six ongoing research projects. The November 2013 and January 2014 workshops took place at MIT and were attended by more than 40 students, affiliates, and researchers from CCES at KACST. Among them were 10 newly appointed researchers and principal investigators based in Riyadh. Over spring break in March, more than 20 MIT-based affiliates traveled to Riyadh to participate in workshop meetings and make presentations of their research directly to stakeholders. Several groups of faculty and students were invited to visit stakeholder organizations such as the Arriyadh Development Authority and the Saudi Telecom Company to gain an inside view into the real-world application of their research and inquiry. Also during this visit, Professor de Weck delivered the first career development and academic planning workshop to the research affiliates involved in the Advanced Training Program at CCES. In summer 2014, we inaugurated our new CCES MIT facility with a three-week workshop and research collaboration period for all of the center's affiliates.

Research Projects

In 2013–2014, CCES ran six independent but interrelated [research projects](#).

Publications and Dissemination of Research

To date, CCES-funded affiliates have authored or co-authored approximately 50 publications. More than 15 of these publications were jointly authored by CCES researchers based both at KACST and MIT, highlighting the fruits of our international collaboration. Links to these articles as well as biographical information about our affiliates can be found on the [CCES website](#), which was redesigned and launched in spring 2014.

CCES researchers have also delivered papers and keynote addresses at several leading international conferences, including the Complex Systems Design and Management conference in Paris in December 2014.

Intellectual Mentorship and Capacity Building

In 2014, affiliates of the CCES-KACST Advanced Training Program were accepted to graduate programs at some of the world's leading institutions of higher education

in engineering and science, including MIT. Six scholars from the program have been accepted to graduate programs at MIT in civil and environmental engineering and computer science and engineering, as well as the Media Lab. Others have gone on to start graduate studies at Oxford, Cambridge, Imperial College, McGill University, and the University of California, San Diego.

Staffing and Administration

In 2014 CCES welcomed Richard Larson, Mitsui professor of engineering systems in ESD, as the new faculty deputy director.

CCES has an annual budget of about \$2.5 million at MIT based on a 10-year collaborative agreement (2011–2020) with KACST.

Olivier de Weck

**Co-Director, Center for Complex Engineering Systems at KACST and MIT
Professor of Aeronautics and Astronautics and Engineering Systems**

Center for Engineering Systems Fundamentals

Research and educational initiatives at the [Center for Engineering Systems Fundamentals](#) were funded by a variety of sources during AY2014.

The Education-as-a-Complex-System group is funded by a four-year grant from the National Institutes of Health (in collaboration with Ohio State University) and by a three-year contract from Fujitsu Laboratories of America. Progress has been made on a number of fronts, including an analysis of how the number of PhDs generated by faculty researchers in the biological and life sciences is far more than can be absorbed in academia. Prospective doctoral students in these fields must be informed of the high likelihood that their careers will be elsewhere, such as a research laboratory in the private or public sector. With Fujitsu support, work was completed on a proposed new system design combining Internet-based lesson sharing in the United States with a group-based “[lesson study](#)” initiative in Japan. Our Fujitsu work on Guided Learning Pathways—a flexible user-customized learning environment—is about to be published in the journal *Creative Education*.

Our pandemic influenza research, supported by the US Centers for Disease Control and Prevention (under a five-year cooperative agreement with the Harvard School of Public Health) and the Alfred P. Sloan Foundation of New York, was completed over the past year. A summary document of our five-year program was written and is under review for publication.

[Blended Learning Open Source Science or Math Studies](#) (BLOSSOMS), an initiative of the **Learning International Networks Consortium** (LINC), is supported by the William and Flora Hewlett Foundation, the Alfred P. Sloan Foundation of New York, the Lord Foundation of Massachusetts, the Lounsbery Foundation, and Universiti Teknologi Malaysia (UTM), with corporate sponsorship from Fujitsu of America, IBM, Saudi Aramco, and the Verakin Group of China (new this year). More than 100 BLOSSOMS

video learning modules are now available from MIT, Jordan, Lebanon, Pakistan, Saudi Arabia, and Malaysia. Modules are also available from volunteers in the Washington, DC, public school system and Singapore, as well as volunteers at Georgia Tech, the University of Wisconsin, IBM, and Teachers Without Borders. During the past year, the program offered several teacher training workshops in Massachusetts, at UTM, and at Verakin High School in Chongqing, China. New BLOSSOMS lessons have been created by MIT students, by Massachusetts public high school teachers, and by teachers in Malaysia and China. The growing number of BLOSSOMS redistributors—including [Gooru](#), [CPALMS](#), [ShareMyLesson](#), [TES Connect](#), [egranary](#), [Canal Futura](#), and [OER Commons](#)—shows the strong acceptance of BLOSSOMS as an important and unique source of educational resources focused on STEM subjects.

Professor Larson serves as co-chair of the Innovation Collaborative on Systems Engineering in Health, cosponsored by the Institute of Medicine and the National Academy of Engineering.

Richard Larson

Director, Center for Engineering Systems Fundamentals
Mitsui Professor of Engineering Systems

MIT Center for Transportation & Logistics

The [MIT Center for Transportation & Logistics](#) was involved in 96 active research projects in FY2014. Major projects and initiatives are described below.

MIT Global Supply Chain and Logistics Excellence Network

The [MIT Global Supply Chain and Logistics Excellence \(SCALE\) Network](#) continued to enhance its offerings. CTL is exploring additional centers in China, India, and other global logistics hubs.

Center for Latin-American Logistics Innovation

The [Center for Latin-American Logistics Innovation](#) (CLI) has cultivated deep relationships with 27 top Latin American universities and institutions outside the region. It currently has nine full-time research staff and, as an official national center of excellence, has access to government grants and various thought leadership opportunities.

The 40 students in the sixth class of the Graduate Certificate in Logistics and Supply Chain Management program were selected from 56 applicants and hail from 18 universities across Argentina, Brazil, Colombia, Mexico, Peru, Ecuador, Chile, and Venezuela. To date, the program has graduated 105 students, hosting them twice at MIT (first in July and then in January, each for a period of three weeks) alongside students from CTL, the Zaragoza Logistics Center (ZLC), and the Malaysia Institute for Supply Chain Innovation.

The second CLI initiative in education is to “teach the teachers” through a series of English-language academic workshops that take place annually at various venues in the region. The latest workshop took place in November 2013 in Lima, Peru, following

a series of meetings in the United States, Panama, Colombia, Brazil, and Ecuador. Also available at the faculty level are three- to six-month visiting research fellow positions at CTL. In the past five years, 10 faculty members have taken advantage of this program: three from Mexico, two from Colombia, two from Chile, and one each from Panama, Brazil, and Ecuador. Visiting faculty stays are focused around research themes.

Corporate education is CLI's third educational initiative. The center currently has 12 corporate partners with which it develops a wide range of executive and collaborative research.

Zaragoza Logistics Center

In 2013–2014, the [Zaragoza Logistics Center](#) included eight faculty members, 10 researchers and doctoral students, and 22 professionals in finance, marketing, information technology (IT), human resources (HR), and education and research management.

In May, 55 students from 17 countries were awarded their degrees at the University of Zaragoza's Paraninfo Hall. The students came from the 12th class of the Master de Logística (MdL) and the ninth class of the MIT-Zaragoza Master of Engineering in Logistics and Supply Chain Management (ZLOG) program, as well as from the MIT-Zaragoza PhD in Logistics and Supply Chain Management program.

In 2013, for the third consecutive year, the ZLOG program was ranked first in the field of logistics in El Mundo's rankings of the 250 best master's programs in Spain.

Graduates of the ZLC MdL program won the international "DHL Apps" competition, the national COMPROMETI2.0 Award, the Foro Pilot Award for the Best MdL Master Thesis, and the Asociación Empresarial PLAZA Award.

The MIT-Zaragoza doctoral program had nine students in 2013, two of whom successfully defended their dissertations to complete their PhD program requirements.

Forty-four PhD students from universities across the globe participated in the sixth edition of ZLC's annual five-week PhD summer academy.

More than 150 professionals participated in different executive education programs in supply chain management designed and taught by ZLC and MIT SCALE faculty for diverse organizations such as the INCAE Business School, the Spanish Military, and Kazakhstan Railways.

In 2013, there were 22 ongoing research and development (R&D) projects at ZLC. Funding sources included the European Commission, private companies, the Spanish Ministry of Economy and Competitiveness and Ministry of Industry, and the Centre for Industrial Technological Development.

In 2013 ZLC had the second highest number of European R&D projects in Spain in the area of logistics and supply chain management, and in early 2014 the center moved to the number one spot.

Over the past year, ZLC promoted the constitution of the Alliance for Logistics Innovation through Collaboration in Europe (ALICE), which the European Commission has officially recognized as a leader in the context of the strategy for European Technology Platforms. The director of ZLC is a member of the ALICE steering group, and the ZLC director of research programs leads the ALICE secretariat.

Research at ZLC has resulted in five articles published in peer-reviewed journals and several research reports. ZLC faculty and research staff presented their research findings at key national and international conferences. “Cisco Systems, Inc., Supply Chain Risk Management,” developed by Maria Jesus Sáenz (ZLC faculty member) and Elena Revilla, won the 2013 Case Writing Award from the European Foundation for Management Development in the Supply Chain Management category.

ZLC also organized several outreach activities that attracted several hundred attendees during 2013. Major events included the Mathematics of Operations and Logistics Conference, Supply Chain and Logistics Innovation Week, the 6th European Conference on ICT for Transport Logistics, and the celebration of ZLC’s 10th anniversary. Highly acclaimed speakers from universities and multinational companies around the globe participated in the MIT-Zaragoza speaker series organized at ZLC.

In 2013, ZLC obtained over 1 million euros in direct funding for public and private research projects and education. Due to the recession in Spain and weak economic conditions throughout Europe, ZLC’s total revenues decreased by 10% from 2012 to 2013. However, ZLC reduced its total expenses by more than 17% in 2013 without compromising the quality of its educational and research activities.

ZLC also had a direct financial impact in the local community: more than 1.5 million euros were estimated to be spent in Aragón by ZLC visitors and students from outside Spain.

Malaysia Institute for Supply Chain Innovation

The [Malaysia Institute for Supply Chain Innovation](#) (MISI), launched in 2011 by the Malaysian prime minister as a joint effort with MIT, is now in its third operational year as an institute of higher learning. In January 2014, MISI initiated a new part-time MSc program (PSCM) to complement the very successful full-time MSc degree in supply chain management (MSCM). Both programs embody the MIT Global SCALE Network’s commitment to delivering top-flight innovative supply chain management training in Asia. MISI is actively working on preparing the needed application for the initiation of a PhD program in 2015, in alignment with the original five-year strategic plan. To keep pace with its growing needs, MISI recently hired two new faculty members who are accomplished researchers with strong credentials.

The second MSCM class boasted a student body of 21 MSc midcareer professionals from 11 different countries. The students successfully graduated in May. The graduating class did exceedingly well on the job market in terms of their placement expectations, with job offers from such companies as Schlumberger, Deloitte SEA, Starbucks, PWC, and McKinsey & Company. During the last semester of the program, 15 students accepted three-month internships with Schlumberger. As a result of these internships, three students were offered (and accepted) full-time management positions after graduation.

The first PSCM class began in January with a group of 12 students, and the second will begin in September 2014. The PSCM program is designed for professionals who are interested in furthering their knowledge in the area of global supply chain management by improving their academic and professional profile.

The MISI Supply Chain Leadership and Innovation Program continues its development in Singapore. To date, four groups of participants have completed this training program, and there have been a total of 33 graduates. These graduates are middle- to senior-level executives and hail from companies such as Becton Dickinson, Yang Kee Logistics, Molex Singapore, Rolls-Royce Singapore, and Franson International.

As part of MISI's resident training program, 70 master's of finance students from Kazakh Economic University's International Business School attended a four-day program in January. The MISI resident program aims to deliver a selection of academic lectures, supply chain management simulations, and industry visits to help students develop a comprehensive understanding of logistics and supply chain processes.

MISI successfully held its second supply chain conference in March; the theme was "Design Anywhere, Make Anywhere, Deliver Anywhere." The event, held at the Central Bank of Malaysia, included a dynamic range of speakers who explored future innovations in supply chain management. The conference attracted more than 250 global participants.

In May, MISI held a ceremony recognizing the generous support and commitment of Yayasan Sime Darby to MISI in pursuit of excellence in higher education.

MISI held a customized two-day supply chain program for the YTL Cement Group. Also, MISI hosted a four-day training workshop for the Asian International Economists Network in June. Fifty individuals from 27 different countries took part in the workshop.

MISI faculty published three articles in academic journals along with submitting six conference papers and seven journal papers. In addition, faculty members presented at more than 10 international conferences in the areas of supply chain strategy, supply chain risk management, port logistics, and maritime and intermodal logistics.

Preparations are under way to host the 2015 International Association of Maritime Economists conference, a first for Malaysia and Southeast Asia. The conference theme is "Maritime 2025: The Role of Maritime Clusters and Innovation in Shaping Future Global Trade."

The third class of MSc students, which includes 25 full-time students from 12 different countries, will start in August. The students will be actively engaged in coursework and thesis projects sponsored by MISI industry partners including Air Asia, CHR Hansen, Hanesbrands, Procter & Gamble, Ralph Lauren, Schlumberger, the World Food Program, Starbucks, Cummins, Linc Logistics, BASF, and Hershey.

Environmental Supply Chain Management

Following the completion of the [Leaders in Environmental Assessment and Performance \(LEAP\)](#) initiative in 2013, environmental work has shifted to the writing of a book on green supply chain management. The book is expected to be published in 2015.

MIT Megacity Logistics Lab

Starting in 2012 as an outgrowth of research activities in logistics and supply chains in emerging markets, CTL created the [MIT Megacity Logistics Lab \(MLL\)](#) to focus on understanding and transforming the supply chains that interface with megacities.

MLL has secured seed funding from MISTI, the Itaú Foundation, and the International Research Opportunities Program (IROP) office to support partnerships, workshops, and data collection efforts in a number of cities around the world (Beijing, Bogotá, Casablanca, Kuala Lumpur, Madrid, Mexico City, Rio de Janeiro, Santiago, and São Paulo).

More than 300 people from business, academia, and government have participated in MLL activities. Eighteen MIT students, including 10 undergraduates, have experienced firsthand the challenges of freight movement. MLL has also hosted doctoral students from Portugal, Germany, Mexico, Brazil, and Chile as it builds its research agenda.

In 2013, MLL launched the first “global urban logistics atlas” with the goal of providing policymakers and logistics managers with standardized, detailed, and context-specific information on patterns of logistics intensity in megacities. A second version of the logistics atlas was launched in 2014, including new data collected in Mexico City, Bogotá, Santiago, and Singapore. MLL has also started to develop partnerships within MIT with other related initiatives such as City Science, the Center for Advanced Urbanism, and SMART.

MIT Hi-Viz Project

The [Hi-Viz](#) (high visibility) project seeks to establish an automated system that will create near-real-time, board-ready displays of a company’s end-to-end supply chain and highlight areas of risk or concern on those displays. CTL partnered with Sourcemap.com, a start-up company formed by a recent MIT PhD student, in implementing the initiative. The initial three-year research project, which concluded in March 2014 and was complemented by two master theses, succeeded in creating two valuable high-level displays of the supply chain: an interactive map and an interactive material flow diagram. Metrics highlighted atop these displays include inventory levels, recovery times, risk exposure, value at risk, and customer blackout days resulting from the loss of network suppliers. Along with geo-emergency alerts added to the displays, initial progress was achieved in adding geo-based underlying (baseline) natural disaster probabilities to each node in the supply chain.

As a result of this project, one large multinational sponsor has launched a large internal IT project to build a global working version of the Hi-Viz software for its private internal use. Another large multinational company is engaging with MIT and Sourcemap.com to implement the software at each of its 24 sourcing centers globally over the next three

years. A third multinational firm is sponsoring a follow-on thesis project to explore ways to approach and capture data on its supply chain. MIT is moving forward on the Hi-Viz project by working with AIR-Workwide, a behind-the-scenes analytical firm that calculates natural disaster-based loss probabilities for the insurance industry. This work will enable the Hi-Viz software to receive feeds of both baseline disaster probabilities and real-time event-driven probabilities.

Supply Chain 2020 Project

The [Supply Chain 2020 Project](#) (SC2020), launched in 2004 to address the issue of preparing supply chains for future challenges and later refocused to develop a toolkit rethinking supply chain strategies, is now reaching its conclusion. The ideas behind the SC2020 toolkit have been thoroughly tested in half a dozen projects with several organizations, including Fortune 100 companies, the United Nations, and the federal government. Significant progress has been made toward documenting the toolkit in the form of an actionable guidebook that can be applied by practitioners. A first draft of this guidebook should be completed by the end of 2014, with a second draft (to be published online) expected by 2015. Currently, one project with an industry-leading organization is being conducted to provide key examples for use in the guidebook.

Humanitarian Response Capacity

The [Humanitarian Response Lab](#) (HRL) completed its first year as part of the [MIT Comprehensive Initiative on Technology Evaluation](#), supported by a five-year grant from the US Agency for International Development. Work focused on evaluation of solar lanterns in Uganda and water treatment devices in India. Other funded research projects this year were conducted with the United Nations World Food Programme (WFP), the Federal Emergency Management Agency, the New England University Transportation Center, and GlaxoSmithKline. HRL also participated in [MIT's response to Typhoon Haiyan](#) by working with the Philippine Red Cross and WFP to design new supply chain strategies that increase response capacity in the Philippines.

HRL education efforts continued through the MIT graduate course on humanitarian logistics and collaboration with Harvard and Tufts on “Essentials for Humanitarian Action in the Field,” a three-day simulation held in a state park near Boston. HRL co-organized the sixth annual [Health and Humanitarian Logistics Conference](#) in Mexico City in June, drawing 150 participants from around the world.

Logistics Clusters

In October 2012, professor Yossi Sheffi's book [Logistics Clusters: Delivering Value and Driving Growth](#) was published by MIT Press. The book won the Professional and Scholarly Excellence Award from American Publishers and is now in its fourth printing. A Spanish edition was published in 2014, and a paperback edition is scheduled for the end of the year. Also, a Chinese edition is in the works. The work spawned many academic and industry publications in 2014.

MIT FreightLab

The [MIT FreightLab](#) was very productive this year, with more than half a dozen graduate students, postdoctoral candidates, and researchers participating in various

activities. Work was focused on teaching graduate-level courses, advising master's thesis projects, continuing work on long-standing research initiatives, running executive roundtables. The FreightLab continued to offer ESD.266 Freight Transportation Systems & Analysis, which was attended by 22 students from engineering, management, and urban planning.

FreightLab students produced six master's theses on topics that included load assignment optimization, distribution strategies, and order routing and scheduling. Sponsored freight thesis projects were completed for Amazon, Coyote Logistics, and Niagara Waters.

Work continued on two long-running research projects: [Future Freight Flows](#) (FFF) and Living Plan. The FFF project, sponsored by the US Department of Transportation, was completed. The material developed for scenario planning has been incorporated into overall master's- and executive-level educational programs. The FreightLab has conducted additional FFF-based scenario planning engagements with organizations ranging from the United Nations to 7-Eleven stores. The FFF scenario planning approach was adopted for use by ABInBev in the creation of a strategic playbook. This new extension to the FFF models connects long-range forecasting to short-range tactical planning. The Living Plan project, sponsored by the United States Transportation Command, is entering its fourth year. This project explores methods of developing robust transportation planning tools under uncertainty. The work is based on the pioneering efforts of FreightLab researchers in an earlier project with Wal-Mart. The project examines how robust planning and operational flexibility interact. A large-scale simulation test bed is being created to understand the trade-offs of these different approaches to managing uncertainty.

New England University Transportation Center

MIT was competitively awarded the US Department of Transportation's grant for the [New England University Transportation Center](#). This consortium of universities includes MIT as the lead institution along with the University of Connecticut, University of Maine, University of Massachusetts, and Harvard University.

The grant will be used to support students, researchers, and faculty in the further development of a living laboratory in Cambridge, the Massachusetts Avenue Area Living Laboratory (MALL), with an urban landscape from Harvard Square to Memorial Drive. MALL is the first project of its type to create a platform for research and education in technology development and deployment, travel behavior, retail and commercial development, architecture, and design with a special focus on disadvantaged populations.

AgeLab

[AgeLab](#) has grown in the number of students, staff, and faculty from engineering, social and behavioral sciences, and management as well as from Harvard Medical School. AgeLab now enjoys sponsorship from corporations that have previously not been engaged by ESD or were involved in the needs of an aging society (e.g., retail, auto, financial services, pharma, and consumer products). AgeLab is recognized worldwide

as an innovator in understanding the demands of an aging society and its impact on various complex systems including transportation, health, finance, and community development. Last year AgeLab conducted experiments and field work that involved nearly 800 participants on campus along with approximately 10,000 individuals from five countries who took part in field trials of hardware, surveys, focus groups, and in-depth interviews.

Port Resilience Project

CTL is a funded partner in the National Center for Secure and Resilient Maritime Commerce, a Department of Homeland Security Center of Excellence (Center for Maritime, Island, and Port Security) that was launched in July 2008 with the Stevens Institute of Technology as the lead institution. In response, CTL focuses on developing resilient and secure ports. The [MIT Port Resilience Project](#) builds upon CTL's deep and continuing research on supply chain resilience, supply chain risk management, and supply chain security. MIT's role in the Center of Excellence is developing the principles and actions for making ports resilient to disruptions.

In FY2014, the Port Resilience Project team updated the Port Mapper online application at the request of the US Coast Guard (USCG). The Coast Guard has used Port Mapper in response to three major hurricanes (most notably Hurricane Sandy in 2012) and, as a result of its use of the application, has suggested improvements. These changes, involving automated report generation, intraport distances, and displayed cargo volumes, were made in FY2014.

During FY2014, the MIT Port Resilience Project received additional funding from the Coast Guard to study data, system needs, and decision-making processes affecting port resilience in response to disruptions. The work entailed site visits to several Coast Guard ports including New York, San Francisco, and Houston. This project addition will conclude in FY2015.

CTL Outreach

The foundation of CTL's corporate outreach is the Supply Chain Exchange, believed to be the largest and most active membership program in the supply chain management field. A list of exchange partners is available on the CTL [website](#).

Corporate Relations

During FY2014, CTL dropped six companies from the Supply Chain Exchange: Schneider National, Independent Purchasing Cooperative (IPC), Staples, Chiquita, WWL, and NYK Lines. CTL continues to maintain and nurture its relationships with these companies and expects some to resume active membership in FY2015. Ten companies were added as partners to the exchange: Johnson Controls, Dell, Delhaize, Railex, Starbucks, Unilever, Amazon, Cintas, Matson, and Hershey.

Events

CTL hosted the fifth annual partners meeting on March 26, which convened key contacts from CTL's partner companies for a review of research and customer feedback

and input sessions. This year's CTL Crossroads Conference (March 25) focused on the innovations driving another decade of revolutionary change in the supply chain world. The conference featured experts from MIT speaking about the technologies that are likely to affect supply chain management in the future.

CTL held two sessions (in January and June) of its major supply chain management executive education course, "Supply Chain Management: Driving Strategic Advantage." In addition, CTL conducted custom scenario-planning workshops at partner locations. CTL also planned and delivered several custom educational programs for a key partner that featured new educational content developed from research.

On January 22, CTL held its sixth annual networking night/poster session. Approximately 120 students from the SCALE Network programs (CTL, ZLC, CLI, and MISI) presented over 80 thesis projects to more than 80 representatives from 50 companies. Earlier that day, CTL hosted its fourth Supply Chain Talent Management Forum for HR and supply chain management executives.

CTL also hosted the following events for CTL Supply Chain Exchange partners:

- Supply Chain Leadership Workshop (October)
- Environmentally Sustainable Supply Chains Roundtable (November)
- Supply Chain Risk Roundtable (at Starbucks headquarters) (April)
- Last Mile Delivery Roundtable (May)
- Research Fest (student thesis final presentations) (May)

Personnel

In FY2014, new hires and appointments at CTL included Andres Felipe Archila Tellez, research associate; Daniel Brown, technical associate; Arielle Burstein, technical associate; Jaime Andres Castaneda Acevedo, postdoctoral fellow; Olivia DaDalt, technical associate; Catherine Date, coordinator of corporate outreach; Chaiwoo Lee, postdoctoral associate; Joonbum Lee, postdoctoral associate; Samuel Leuscher, research associate; Thomas McWilliams, technical associate; and Thea Singer, lecturer. In addition, visitors to CTL included visiting military scholars Colonel James R. Becker, Colonel Mark W. Colvis, and Colonel E. Deacon Maddox; domestic and international visiting scholars David Gligor, Gisele Mendy Bilek, and Eva Ponce Cueto; and international visiting students Karla Balderas Perez, Gustavo Beauregard, Sergio Caballero, José Cohen, Francois-Xavier Delmonteil, Enrique Abdon Garcia Perez, Philipp Langhans, Victor Manuel Martinez, Ana Teresa Mendez, Jorge Moreno, Andre Romano Alho, Adrian Rumpold, Cecilia Silva, Alina Sinelnikova, Francesco Stefanelli, Alex Waldermann, and Dimitri Weideli.

Departures from CTL included Anthony Craig, Cheryl McLeod, Robert Vaz, and Yan Yang.

Recognition

CTL's 2013–2014 United Parcel Service Fellowships were awarded to two outstanding students studying logistics, freight transportation, or supply chain management: Paul Leopando (master of science fellowship, Supply Chain Management Program) and Serdar Colak (PhD fellowship, Department of Civil and Environmental Engineering).

In addition, "Classifying Driver Workload Using Physiological and Driving Performance Data: Two Field Studies," by Erin Solovey, Marin Zec, Enrique Garcia Perez, Bryan Reimer, and Bruce Mehler, received a Best Paper Award honorable mention from the Association for Computing Machinery. This award is considered a very prestigious honor in the computer science community.

As noted above, Professor Sheffi's book *Logistics Clusters* won the American Publishers Professional and Scholarly Excellence Award. The award was presented at the Association of American Publishers' 37th Annual PROSE Awards.

Yossi Sheffi

Director, MIT Center for Transportation & Logistics

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

MIT Supply Chain Management Program

The [MIT Supply Chain Management Program](#) continues to receive six to seven times as many applications as there are available slots in the program.

SCM collaboration with other SCALE programs (in Malaysia, Latin America, and Spain) continues to increase, with cross-center teams and international travel. All SCALE students congregate at MIT in January for an intense month of team projects, lectures, workshops, and presentations, followed by a one-week trek to Spain, China, or Panama.

SCM has established the MIT Supply Chain Excellence Award at 11 undergraduate programs in nine leading US universities. The award is given annually to the most outstanding graduating supply chain or industrial engineering major in each school (only US citizens are eligible). To date, seven students have won the award, and 10 have received honorable mentions. Winners and honorable mention recipients are given a partial scholarship to attend SCM.

2014 SCM Class

In spring 2013, 37 students (10 women and 27 men) were selected from more than 260 applicants to join SCM as its class of 2014. Students came from 14 countries; their average age was 30 (with a range from 23 to 40), and they had an average of five years of professional experience.

A total of 80 companies recruited SCM students in 2013–2014. Among students who sought employment, 91% had received job offers by graduation. SCM students received an average 57% boost in salary, with the average outgoing annual base being \$110,000 (ranging from \$68,000 to \$135,000).

SCM Thesis Partners

Eighteen companies participated as Supply Chain Exchange thesis partners. This year's projects included:

- Demand Signals for New Products (semiconductor manufacturer)
- Capacity Constrained Carrier Selection (Internet retailer)
- Direct to Store Transportation (beverage company)
- Quality Problems Cause Stock-outs (pharmaceutical company)
- Calculating and Visualizing SC Risks (oil field services company)
- Tie Inspection Data Analysis (class 1 railroad)
- Executing Supply Chain Resiliency (agricultural chemical company)
- 3D Printing Impact on Supply Chains (logistics service provider)
- Optimal Freight Profile for Carriers (truckload brokerage firm)
- Estimating LTL Emissions (truckload brokerage firm)
- Optimal SC for Sales Samples (consumer good company)
- Mapping Strategic SC Risks (chemical company)
- Inventory, Sourcing, and SC Risk (medical device company)
- Visibility into SC Flow (food manufacturer)
- Business Continuity Plan for US SC (luxury apparel company)
- Distribution for Southern Africa (pharmaceutical company)
- Certified Receiving Using SPC (major drugstore chain)
- Speed to Market SC Design (apparel and general merchandise retailer)
- Scenario Planning (chemical company)

SCM Alumni Interaction

SCM has more than 470 alumni, in addition to 400 alumni from other SCALE centers. SCM alums are working on six continents in myriad industries.

CTL held its ninth annual alumni reconnect event in May 2014; the theme was "The Road Less Traveled: Unique Career Paths." This year we also created the [SCM/SCALE Alumni Job Board](#), an online database of available positions for our alumni to use as an additional resource.

Bruce Arntzen

Executive Director, Supply Chain Management Program