MIT–Portugal Program

The MIT–Portugal Program (MPP) is a large-scale international collaboration involving MIT and government, academia, and industry in Portugal to develop education and research programs related to engineering systems. This high-level partnership represents a strategic commitment by the Portuguese government to science, technology, and higher education that leverages MIT's experience in these important areas to strengthen the country's knowledge base through an investment in human capital and institution building.

MPP was designed as a high-profile effort to demonstrate that an investment in science, technology, and higher education can have a positive, lasting impact on the economy by addressing key societal issues through quality education and research in the emerging field of engineering systems. The goals of the overall operation include the creation of a unique partnership between MIT and seven universities, 15 research centers, and associated laboratories in Portugal to jointly advance the field of engineering systems and create unique and significant research opportunities that integrate with new education programs in four engineering systems–related disciplines.

This engineering systems collaboration emphasizes large-scale systems that have not only critical technological components but also significant enterprise and sociotechnical level interactions that call for engineers in leadership positions to have training in engineering systems that goes beyond traditionally defined engineering disciplines.

The Portuguese government, through the Ministry of Science, Technology and Higher Education, entered into a long-term (five year) collaboration with MIT focusing on research and education in October 2006. The objectives, framework, and structure of the collaboration were developed during a five-month assessment conducted by MIT between February and July 2006, which recommended that MIT foster collaborations with Portuguese institutions based on the excellence of the research identified in Portuguese research centers. The study acknowledged the Portuguese government's commitment to strengthen science and technology and promote international collaborations in higher education, science, and technology, making Portugal an interesting place for doing research and a relevant partner for future collaborations in the emerging knowledge-based, globalized economy.

Focus Areas

The MPP program is hosted at MIT by the Engineering Systems Division (ESD) and includes collaborations with various other departments, labs, and centers at MIT. The following fields represent the four focus areas for the MIT–Portugal collaboration: bioengineering systems, engineering design and advanced manufacturing, sustainable energy systems, and transportation systems. A separate, integrative program in engineering systems has also been developed.

A number of joint research and educational projects were undertaken in each focus area between July 2007 and June 2008 involving participants from Portugal and MIT.

Educational programs were launched in September 2007 and vary for each focus area, consisting of a mix of doctoral programs and professionally oriented master's degrees. Faculty are encouraged to make new educational material publicly available—namely, making use of Creative Commons licensing. At MIT, OpenCourseWare is used.

In all program focus areas, there are several common elements, including the following:

- An engineering systems framework
- A coupling of education and research initiatives
- Collaboration with a consortium of Portuguese universities
- Development of educational programs at three levels: PhD, professional, and short courses
- Interactions with industry
- Developing research projects and educational programs among Portuguese universities
- Developing joint projects between focus areas with cross-cutting flagship projects

Between July 2007 and June 2008, each focus area undertook at least one major workshop in Portugal, prepared progress reports for the program's external review committee meetings, and prepared a third-year annual plan. Each focus area launched its education programs and recently participated in the acceptance process for the next academic class for those educational courses, which will begin again in September 2008. For the next class, the program accepted 99 of 301 applicants (33%) from 39 countries, with MIT focus area leaders participating directly in the student selection process. The program saw an almost 20% increase in applications to the program in its second academic year. This period has been extremely busy for all involved in MPP.

In addition, new research solicitations will be issued for the program beginning in summer 2008. Each focus area will issue solicitations for new projects and expansion of existing projects. Proposals will be evaluated and selections made by the fall. This competition should bring new groups and universities into the Program. It is beneficial to have new participants, but it adds to the complexity of an already complex program.

Following are summaries of the accomplishments and progress of each focus area and the engineering systems program to date as well as future plans and goals.

Bioengineering Systems

The bioengineering systems vision is to create educational and research programs that lay the foundation for the next generation of biotechnology industry, government, and academic leaders in Portugal.

Overall, the objectives of the bioengineering systems program are to:

- Promote new interinstitutional, postgraduate training and opportunities aimed at educating a new generation of leaders in bioengineering technical innovation in Portugal

- Create new knowledge through research and development
- Promote industrial, health care, and environmental biotechnology education and research that make it possible for new start-ups to be created, which implement new models of interaction between universities and enterprises, government, and society
- Provide training and opportunities for Portuguese faculty and students to interact with MIT faculty and students in Portugal and at MIT laboratories

During the last year in the bioengineering focus area several accomplishments were realized. Full implementation of the new joint education program had a positive impact on the highly qualified class of students enrolled during the inaugural year. Eight new course modules for bioengineering systems were developed and cotaught by Portuguese and MIT faculty. The collaboration was truly 50:50 with 17 MIT faculty teaching in Portugal between September 2007 and January 2008 and about four additional MIT faculty offering lectures via videoconference. Extensive student course evaluations were also conducted, with lessons-learned analysis applied to the next academic year.

In November 2007, an experiential leadership weekend designed to go beyond the academic learning environment and to help accomplish the objective "to educate a new generation of leaders in bioengineering technical innovation" was held for all bioengineering systems students and was also attended by five faculty at the Gêres National Park, Portugal.

An initial IdeaSpring event was held in January 2008. It was designed to support the bio-innovation teams (bio-teams) course and will be held annually to evaluate the degree of novelty of the technology selected for the students' work in the bio-innovation teams, the impact of this technology in the market, if successful, and the likelihood of technological success. Prizes were also established, to be awarded in early summer 2008 to the most promising commercial application (Biocant Ventures Prize), the most novel technology (SPI Prize), and the principal investigator with the best proposed technology (GlaxoSmithKline Prize).

The preparation of joint research projects that will involve new PhD students was completed. During the last year, five main collaborative research efforts commenced, including 12 MIT and 30 Portuguese faculty from four universities (Nova, Instituto Superior Técnico (IST), Minho, and Coimbra Centre for Neuroscience and Cell Biology) and other participating institutions. The five projects with subproject goals and deliverables are bioprocess and biomolecular engineering; cell and tissue engineering; computational biosystems, genomics, and synthetic biology; biosystems innovation, management, and policy; and biomedical devices and technologies: hybrid human–machine systems.

In outreach, the bioengineering systems faculty led many activities, including workshops and public speaking. The focus area chartered a steering committee and will hold an annual workshop series on the business/government interface. The steering committee represents pharmaceutical and biotechnology industries and associations, government agencies, and academia, and advises on the selection of the topics and program.

In 2007, the focus area held the first annual workshop on the business–government interface: "Emerging Issues and Opportunities in Biopharmaceutical," which more than 70 leaders from industry, academia, and government in Portugal, the European Union (EU), and the US attended. This annual workshop series is critical to the focus area's plans to develop industrial affiliates in bioengineering systems.

In May 2008, MPP bioengineering and engineering design and advanced manufacturing focus areas hosted a workshop discussing the design, use, regulation, and innovation of medical devices at the University of Minho. Sponsors of the event included the Portuguese Ministry of Science, Technology and Higher Education (MCTES), IAPMEI, Associação Portuguesa da Hospitalização Privada (APHP), and the steering committee on drug development.

Research publications during the past year include two journal publications, three conference papers, one working paper, and two completed MIT theses. Below are a selection of those publications:

- Intracellular delivery of core-shell fluorescent silica nanoparticles, J.E. Fuller, G.T. Zugates, L.Ferreira, H.S. Ow, N.N. Nguyen, U.B. Wiesner, R. Langer, *Biomaterials* (29) 1526–1532, 2008.
- A biodegradable and biocompatible gecko-inspired tissue adhesive, Lino Ferreira, Bob Langer, et al. *Proceedings of the National Academy of Sciences of the United States of America* (105) 2307–2312. 2008.
- A novel engineering systems approach for bioengineering education: the MIT–Portugal collaboration, J.J. Tan, D.J. Newman, J. Cabral, M. Mota, M. Nunes da Ponte, *International Conference on Engineering Education, 2007 ICEE Annual Conference Proceedings*, Coimbra, Portugal, Sept. 2007.
- Engineering of an *E. coli* host for production of plasmid biopharmaceuticals, Diana Bower and K. Prather, *Vaccine Technology II Conference*, Portugal, June 2008.

Engineering Design and Advanced Manufacturing

This focus area emphasizes the development of design as a key academic field. It is aimed at enabling the development of a cadre of innovative leaders who not only are educated in the fundamental elements of technology management and design but also are trained in the practical exploitation of those core skills in the formation and leadership of knowledge-based creative enterprises. Automotive and aeronautic sectors as well as medical devices are emphasized.

The mission of the engineering design and advanced manufacturing (EDAM) focus area is to develop a paradigm for engineering education that closely links high-quality research to novel curricular programs and to promote an entrepreneurial approach to knowledge-based manufacturing and competitive product development.

The recent year activities of the EDAM focus area are summarized below into the following topics: educational programs, research projects, seminars and executive training, and industrial affiliates.

Educational programs: The curricula of all the Leaders for Technical Industries (LTI) and Technology Management Enterprise first-year courses were finalized following the contribution of 46 academics (35 Portuguese faculty from three universities and 11 MIT faculty). The Technology Management Enterprise Advanced Postgraduate Program started with 10 students (engineers from Portuguese industrial companies) and the Leaders of Technological Industries Doctoral Program was launched in September 2007 with 12 students (with an average of five years of previous industrial experience). Joint curricular development for LTI second-year courses is under way, boosting faculty interaction and fostering a deeper integration between the courses of the two postgraduate programs. Quality was assessed in biweekly conference calls between MIT and Portuguese faculties, curricular revision and internal evaluations, and through feedback from students and affiliated companies. In addition, a new design studio at the University of Porto (FEUP) opened in April 2008 as part of the EDAM focus area. It enables students and researchers to create new projects with ties to industry.

Research projects: Collaborative research includes 17 initiatives (tasks) clustered in six projects, covering the targeted EDAM areas. All theses tasks involve MIT, at least two Portuguese universities, and industrial partners. The pilot research project, "Materials and technology selection and evaluation in automotive body components (EOS fender)," in collaboration with VW Autoeuropa, was successfully concluded in January 2008.

Seminars and executive training: Executive seminars with one to a half-day duration were prepared. The following initiatives were scheduled:

- Technology evaluation and selection (based on the results of the EDAM pilot project), IST, Lisbon
- Manufacturing challenges (with EU Manufuture initiative), FEUP, Porto
- Medical devices (joint initiative of Biotech and EDAM focus areas), University of Minho, Braga

Outreach activities were also developed to promote the EDAM areas as future professional opportunities (Escola Gustavo Eiffel, Amadora, January 2008; Escola Francisco de Holanda, Guimarães, February 2008). In May 2008, MPP bioengineering and EDAM focus areas hosted a workshop discussing the design, use, and regulation and innovation of medical devices at the University of Minho. Sponsors of the event include MCTES, IAPMEI, APHP, and the steering committee on drug development.

Industrial affiliates program: The industrial affiliates program is under development aiming at ensuring a deeper industrial involvement in research activities. Exploratory interviews with 27 European companies have been conducted with a focus on marketing the educational program and exploring internships within the LTI internship program (LTI students have a mandatory one-year internship). Active discussions with 20 European companies are ongoing.

Other ongoing objectives for the EDAM focus area for education include the launch of LTI internships in industry (targeting major EU companies), LTI student visits to MIT (coupled with the respective research projects), curricula improvements based

on experience and feedback, and consolidating strong industrial connection through curricula adjustment and student internships.

Future outreach goals include:

- Regular update meetings on education and research activities. These meetings will include discussion of new research project opportunities with visiting MIT people and how to attract new industrial affiliates.
- The organization of four executive seminars aimed at fostering industrial involvement (industrial affiliates and large European companies) and with a focus on the EDAM target areas (automotive, aeronautics, medical devices).
- Interaction with secondary schools. Continuing the outreach initiatives in secondary schools fostering EDAM areas as future professional opportunities (four to six events).
- Interaction with other focus areas (transportation systems, energy systems, bioengineering systems).

Transportation Systems

The overarching focus of the transportation systems program is the design of complex, large-scale systems that have major societal impact and provide opportunities for sustainable economic development. The mission of the transportation area of MPP is development of a cadre of transportation researchers and professionals in Portugal who are trained in the design of a technology-intensive intermodal transportation system, considering it as an integrated whole. The centrality of transportation to social goals and economic and industrial development makes it a vital area to pursue in MPP.

In September 2007, a diploma program in complex transport infrastructure systems (CTIS) was offered for the first time as a pilot and will be offered fully in September 2008. Structure of the CTIS master's program focuses on methods and applications and, with its engineering and business foundations, has advanced several goals, including:

- Producing graduates educated in the technological- and systems-related quantitative approaches required to understand the transportation enterprise as an intermodal integrated system
- Furthering our understanding of institutional, organizational, and political factors in the deployment and operation of transportation systems
- Developing capabilities for future transportation leaders working at the interface between engineering, public policy, and business and financial models

The PhD in the transportation program was jointly offered by the three Portuguese universities starting in September 2007. This program takes three to four years to complete and involves coursework and research in one of the four tracks in the transportation systems focus area, along with visiting student research opportunities at MIT.

The transportation systems focus area held several outreach workshops including a workshop on high-speed rail initiatives and research in April 2008 and another

workshop on air transport systems and services in June 2008, which marked increased participation by air transport industry representatives.

On the research front, the main success has been defining and initiating projects in all research tracks valuable to and consistent with the interests of the four universities involved and transportation stakeholders in Portugal. The four research areas include:

- Intelligent transportation systems: Research aims at implementing new smart transport modes and services to optimize integration with lifestyles and with existing individual and collective transport; in a separate project to provide a pilot service that exemplifies the usage potential of the data collected and of the data fusion engine providing a service to citizens for making public transportation more efficient and pleasant to use; providing support for policy making; and a geographical modeling and visualization module that will use information produced by the data fusion engine.
- High-speed rail: Developing new and innovative lifecycle cost models for high-speed rail, to develop behavior models and define performance requirements for high-speed rail infrastructure, and to achieve a maintenance management system supported by a permanent and appropriated monitoring system and research on incorporating environmental risks (e.g., hydrologic, geotechnical, and seismic), technical risks (e.g., excessive vibrations), and robust measures into decision models for proactive risk management related to construction of high-speed rail.
- Airports and airline systems: Aims to quantify the effects (e.g., delays, capacity utilization) on airline and air transportation system performance and configuration of various proposed technologies (e.g., upgraded, next-generation air traffic control systems) and of policies (e.g., location and number of airports, slot allocations, and other administrative controls) and pricing strategies aimed at addressing airport congestion.
- Integrated systems research: Aims to define innovative solutions with sufficient economic power of attraction for private investment that may simultaneously contribute to urban development patterns that leverage innovative transportation solutions and contribute overall to more sustainable urban development patterns. A particular focus of the work will be on revitalizing urban districts in areas with low availability of street space.

A working paper series was initiated and used to document progress on the various research projects. These papers correspond to outputs from the different research work packages and the education element and are posted on the MIT–Portugal website.

Increased recruitment and marketing to students for the transportation systems PhD program was initiated and conducted mostly at universities and conferences in North America, South America, and Europe.

The transportation systems faculty participated in the acceptance of a new class of PhD students for the focus area.

Future plans for the transportation systems area are to continue the working paper series, explore potential linkages between transportation research and engineering systems research projects, and continue the education and research workshops series.

Sustainable Energy Systems

The sustainable energy systems focus area of MPP works to improve research, education, and outreach in developing cost-effective, robust, and implementable energy strategies to address climate change, energy security, and other sustainability criteria. To achieve this goal, the focus area has been designed to address energy systems from technology and policy perspectives in both space (local, regional, national) and time (near, medium, and longterm) in close cooperation with its industrial affiliates. Coordination across the projects, which address the coupled performance of technology and policy options, will help develop the requisite insights and skills in Portugal and beyond to meet the energy challenges we face in the 21st century.

Over the last year the sustainable energy systems area was able to achieve several goals. In September 2007, the sustainable energy systems educational program was launched with IST, Technical University of Lisbon; Instituto Superior de Economia e Gestão (ISEG), Technical University of Lisbon; FEUP; and the University of Lisbon (FCUL) offering an energy systems PhD. During the first academic year, 40 students were enrolled: 26 in IST or ISEG, 12 in FEUP, and two in FCUL. For the next academic year, beginning in September 2008, the University of Coimbra has already had its program approved by the Ministry. In addition to the energy systems PhD, a one-year professional master's program was offered, in which 20 students enrolled.

A primary objective of the focus area was to engage industry so that the research and educational programs develop knowledge on robust, implementable solutions encompassing climate change, energy security, and the long-term performance of the nation's energy sectors. Some industrial affiliates were already collaborating in specific subprojects under way, with frequent operational meetings occurring since November 2007. With other industrial affiliates, work is still being refined. In the latest February 2008 meeting, where all current industrial affiliates were present, common interests in the sustainable energy systems focus area were established to help define the research and development agenda for the focus area.

Importance was placed on networking between MIT students and PhD students at Portuguese universities. Initial gatherings took place in Oporto in October 2007 so that students could meet in person and start to interact according to their specific interests. Portuguese students traveled to Boston in January 2008 for the annual Alliance for Global Sustainability meeting, where the MIT Energy Box project was presented and additional methodological and scientific exchanges and collaboration occurred. Other networking opportunities included an informal doctoral seminar with MIT, Coimbra, IST, FCUL, and Porto held by videoconference. This seminar began in the fall 2007 term and ran as a formal subject during spring 2008. A video link joins all five schools.

Research topics were reorganized into three overarching sustainable energy systems projects aimed at designing appropriate strategies to cost-effectively meet societal and

environmental energy challenges and develop new energy systems methodologies that capture the dynamics and drivers of energy demand (technology and behavior), energy resources (especially renewable resources), and the networks that connect the two at different spatial and temporal scales, depending on the technology and policy options under consideration. After a series of discussions with the industrial affiliates, the three integrated research projects were designated as:

- Energy planning including economics
- Sustainable built environment
- Energy networks including smart grids

Specific subprojects are being refined and constitute the basis for the PhD students' thesis selection, according to their particular interests and profiles.

Research teams were defined and began productive work in the last year. An idea for an "energy box" product and software theme to bring about more energy efficiency garnered interest from students and faculty from many of the participating universities. A white paper entitled "To intelligent energy infrastructure: achieving energy efficiency through behavioral economics and energy box technology implementation" is available. Faculty from all schools, via visits and video, also met about common core concepts and synergy among subjects.

Finalization of the Green Islands project, which is both a sustainable energy systems initiative and a cross-cutting project for other focus areas was close to completion at the end of June 2008. Through an agreement with government, industry, and academic leaders in the Azores, the Green Islands project involves the Azores and other islands and urban islands around the globe and intends to develop new methodologies to identify cost-effective sustainable energy solutions and options utilizing natural resources that are indigenous to these areas.

Future plans for the sustainable energy systems area include continuing participation in school events like the four that have already been coordinated by Ciência Viva in Lisbon, interaction with other focus area research, integration with flagship projects Green Islands and Green Car, and a yearly research symposium in Portugal to show progress on the work being done in this area as well as other important advances.

Engineering Systems Program

The MPP engineering systems program seeks to directly benefit Portuguese engineering education and practice as it contributes to the development of engineering systems as a new field of study and thereby serve as a model for all of Europe. Program research efforts seek to establish a set of methodologies and fundamental systems concepts that cut across individual domain and sector research areas. Program and curriculum development efforts anticipate the needs of future engineers as systems increase in size, scope, and complexity. By initiating a new PhD program in engineering systems (a major goal of this program) and integrating new systems-based concepts, methodologies, and case studies into the educational initiatives in the focus areas, MPP aims to help establish a portfolio of preeminent ESD-like educational programs in Portugal.

The beginning of the year saw the appointment of João Aires de Sousa of IST as co-lead for engineering systems and, as a result, efforts on the Portuguese side have begun to move forward. The first half of the year involved mostly a continuation of ongoing research and curriculum development activities and, most importantly, the initiation of a process to develop a new PhD in engineering systems in Portugal. Roland Clift, the external review committee member assigned to engineering systems, visited MIT at the end of January 2008 and had successful meetings with MPP leaders and many of the engineering systems principal investigators.

During the last year the engineering systems program was able to make significant progress in meeting its goals.

Curriculum development efforts, particularly for the methodology courses, continued during the last year. Highlights are summarized below:

- "Social Science Research Methods for Engineering Systems Applications" (principal investigator: David Mindell, MIT): During the first half of the year, MIT faculty coordinated with Portuguese colleagues to develop the course as part of the EDAM graduate programs. The first version of the course was taught in Portugal during spring 2008.
- "Models, Data, Inference for Socio-Technical Systems" (principal investigator: Richard Larson, MIT): Search efforts for a postdoc continued, while Richard Larson engaged in discussions with João Aires de Sousa about identifying interested Portuguese colleagues. He traveled to Lisbon and Porto in January 2008, where he presented a series of seminars on these topics.
- "PhD Program in Engineering Systems": Meetings were held in Lisbon in November 2007 involving Daniel Roos and Renee Robins of MIT and Paulo Ferrão and João Sousa of Portugal. The engineering systems team proposed that MPP issue an open solicitation for a consortium of universities and research groups to join together to offer a new engineering systems PhD. The meeting with the deans and rectors also included a special presentation by and discussion with Yossi Sheffi, director of MIT ESD, on the developing field of engineering systems and the history of the creation of the division at MIT; it was followed by a special distinguished lecture for a larger audience delivered by Professor Sheffi at the Luso-American Foundation. Discussion about a draft solicitation occurred, with the expectation that it will be issued as a request for proposals in the coming year.

Research continued to be focused on the MIT side but with outreach and linkages to the focus areas and to Portuguese researchers under way. Below are some highlights:

- "Critical Networked Infrastructure Systems Modeling" (principal investigators: John Hansman and Olivier de Weck, MIT): For this exploratory project, a spring 2008 workshop in Portugal was held. The workshop followed preliminary discussions and saw a mixed industry and academic audience.
- "Health Care Systems" (principal investigator: Stanley Finkelstein): Dr. Finkelstein was engaged in preliminary discussions and hospital visits in Lisbon

aimed at shaping a collaborative research project that will have academics and hospital professionals working closely together.

- "Application of Dynamic Multi-Attribute Tradespace Exploration to the Architecting and Design of a Transportation Engineering System" (principal investigator: Donna Rhodes, MIT): This research is applying an MIT-developed method, dynamic multi-attribute tradespace exploration, to the architecting and design of an engineering system in the transportation systems focus area. In 2007, researchers met with João Sousa to discuss the research project and Professor Sousa's interests in Portugal with regard to engineering systems. The researchers also have met periodically with Maya Abou-Zeid of the transportation focus area and other researchers working on MPP transportation projects to discuss the relevancy of this project to the transportation focus area. Periodic joint meetings will continue to be held to discuss common research interests and outcomes.
- "Carbon-Efficient Supply Chains" (principal investigator: Yossi Sheffi, MIT): The goal of this research is to develop a methodology for characterizing the carbon intensity of supply chains. The research focuses on carbon measurement methodologies as well as the public policy dimensions associated with carbon labels. Project researchers have had substantive discussions with João Sousa of IST, MIT Professor Randy Kirchain (who works with the EDAM focus area), MIT Professor Joseph Sussman (who works with the transportation focus area), and external review committee member Roland Clift. There is great interest in this work and potential collaboration opportunities continue to be explored.

The engineering systems program has several future plans associated with outreach. The Council of Engineering Systems Universities annual meeting is being considered to be held in Portugal, an engineering systems symposium is being considered with joint support from MPP and MIT ESD; two books are being planned: a book on engineering systems by Yossi Sheffi and an MIT Press Book Series on engineering systems by Joel Moses, MIT. Also in development is an international innovation initiative involving Charles Cooney, MIT, (to include MIT–Portugal) that will support and stimulate innovative research that addresses global needs. The initiative will work with the program to maximize impact by building on partnerships and accelerating development of innovative ideas to commercial development.

MIT Portugal Program Outreach

Overall, MPP engaged in a number of outreach activities showcasing research and education as well as the benefit of the university-industry partnership.

A distinguished lecture series was developed this year. It was designed to highlight cutting-edge work in science and technology and brought top innovators to Portugal to share their work in education, research, industry, and society. The first distinguished lecture was given by professor Yossi Sheffi, the director of MIT ESD. The second lecture was given by Irving Wladawsky-Berger, a leader in computer science who holds visiting faculty appointments at MIT and Imperial College.

In November 2007, MIT–Portugal focus area coordinators participated in the third annual Innovation Agency of Portugal innovation sessions, presenting information about the program and its work with industry.

MPP hosted the annual MIT–Europe Conference organized by MIT's Industrial Liaison Program in March 2008 in Lisbon, Portugal. The conference brought together industrial representatives and corporate leaders from around Europe and Portugal as well as academics from MPP and other universities. It was the first time Portugal had been chosen to host the annual conference, which is cosponsored by MPP and the Luso-American Development Foundation. The event provided an excellent opportunity to showcase Portugal's commitment to investing in science, technology, and higher education to an audience of several hundred influential corporate attendees. MPP and MIT faculty spoke at the event under the theme "Strategic Directions: Research, Operations and Organizations." A special session on MPP was held for conference attendees as an opening kick-off event.

Also in March 2008, MIT and the government of Portugal agreed to form a partnership to address critical energy issues and strengthen trans-Atlantic cooperation in energy research. When the agreement is finalized, Portugal will become the inaugural sustaining public member of the MIT Energy Initiative (MITEI), giving a designated representative of the government of Portugal a seat on the MITEI Governing Board, which provides key input on the direction and success of the initiative's overall research portfolio. The collaboration enhances the MIT Portugal Program and its position in energy research and policy.

In April 2008, Portugal's Minister of Science, Technology and Higher Education, Jose Mariano Gago, gave this year's annual Miller Lecture sponsored by MIT ESD. Gago's talk, titled "The Future of Science and Technology in Europe," drew a large crowd of interested faculty members, MIT officials, and students.

Program Budget and Finances

The anticipated total public budget for the first five years of the MIT–Portugal partnership in engineering systems amounts to around 65 million euros (US $82 million), from which 33 million euros are to fund activities at MIT (US $41 million) and 32 million euros are public funding to Portuguese institutions. In addition, private funding will be used to support activities in industrial affiliates and to support advanced professional education programs.

In late 2007, the Luso-American Foundation awarded $500,000 in support to MPP, naming it the Enhanced MIT Portugal Program Fund, which will be used to supplement existing government funding.

Communications

In fall 2007, a new branding exercise was conducted to highlight the main themes of MPP, including its bold, modern, and unique approach to science, technology, and higher education. Deliverables from this project included a new logo, new imagery for the program, and a set of new brochures, all of which had buy-in from both the MIT

and the Portugal sides of the program. These new materials are being used for student and industry recruitment and general public relations and promotion in Portugal and at MIT. In the beginning of 2008, a new comprehensive and user-friendly website was launched to be consistent with the new MIT–Portugal brand and to encourage additional involvement form both sides of the program in terms of website content. The new site was in development for half a year and is a significant improvement over the previous version. An e-newsletter designed to increase information sharing and communication among program participants is under development.

The program was also able to gain positive placement in several Portuguese media outlets over the course of the year and was able to promote the positive aspects of the program specifically. Through strategic communications planning program leaders have given several positive interviews on the progress the program has made in the last year; the increased involvement of industry; the role the program has and is playing in the reform of Portuguese higher education, science, and technology; and the impact the program has made on the lives of those involved in the program. The program was also featured in a special section of the *Financial Times*.

Governance

The program governance structure includes a program governing committee responsible for policy oversight with respect to overall objectives of the relationship as well as approval of the annual plan and budget allocation for the proposed activities in the annual plan; a program operating committee responsible for developing and initially approving annual plans in the focus areas; and an external review committee, which will review and comment on the annual plan and evaluate the program based on the specified program objectives.

The program governing committee and program operating committee, simultaneously with their respective review and approval of MIT's annual plan, apply the same review and approval process to the annual plan of the Portuguese institutions that are committing to collaborate with MIT on a project or program.

The external review committee, which meets at least twice each year, consists of distinguished external advisors with expertise in the focus areas and has an important role in development of the program. Its independent review includes recommendations about alterations in the annual plan and budget to support achievement of the overall objectives of the MIT–Portugal collaboration.

The specific activities to be undertaken by MIT and the Portuguese consortia are specified in the annual plans. Since the projects involve both MIT and Portuguese institutions, the successful execution of joint activities requires each side to carry out its contractual responsibilities. The MIT annual plan will focus on those activities MIT will undertake, and the Portuguese annual plan will focus on the activities by all the Portuguese institutions involved in each focus area. The Portuguese organizations involved in the MIT–Portugal collaboration explicitly acknowledge their institutional commitment to the overall program and the specific activities in the annual plan by means of a written commitment, on which MIT may rely, to participate in the MIT–

Portugal collaboration through collaborations with MIT in the focus areas. These commitments specify how each institution will contribute to the overall program in general and to specified projects in particular.

Industrial Affiliates

Each of the thematic focus areas is involved in this companion effort involving MIT–Portugal industrial "affiliates" with the goal of fostering new research consortia in collaboration with MIT, leading to new frontiers of trans-Atlantic collaboration in science and technology. In March 2008, several new industrial associations joined the MIT–Portugal program as industrial affiliates. The Portuguese Industrial Association, the Portuguese Association of Companies, the Forum for Business Managers, and the Proforum–Association for the Development of Engineering joined the program to promote the connection of the Program to Portuguese companies and its social and economic impact. A ceremony marking the partnership took place during a dinner on 26 March during the MIT–Europe Conference (25–27 March), when the presidents of the associations, and the president of the Portuguese Science and Technology Foundation, João Sentieiro, signed the affiliation agreement between the associations and MPP. In late spring 2008, the program hired a new research–industry affiliates liaison to work from the Lisbon, Portugal, office and to work directly with industry affiliates and recruit new members of this program.

Leadership

The MIT program director is Daniel Roos, professor and founding director of the Engineering Systems Division. The Portuguese program director is Paulo Ferrão, professor at the Instituto Superior Técnico, Technical University of Lisbon. Both are assisted by a team of joint coordinators for each focus area, as follows:

EDAM:

- Joel Clark and Chris Magee, professors at MIT, ESD
- António Cunha, professor in the School of Engineering, University of Minho

Energy systems:

- David Marks, professor at MIT, ESD; John Fernandez, professor, MIT, School of Architecture; and Steve Connors, research engineer, MIT
- Paulo Ferrão, professor as IST, Technical University of Lisbon

Transportation systems:

- Christopher Zegras, assistant professor of transportation and urban planning, Department of Urban Studies and Planning
- José M. Viegas, professor at IST, Technical University of Lisbon

Bioengineering systems:

- Dava Newman, professor at MIT, ESD
- Manuel Nunes da Ponte, professor in the School of Sciences and Technology, Universidade Nova de Lisboa

Personnel

With MPP now fully under way, no significant additions were made to the program's staff at MIT.

In early 2008, four MIT professors involved with MPP were named visiting professors at IST in Lisbon: Dan Roos, Japan Steel Industry professor of engineering systems and civil and environmental engineering, MIT, Engineering Systems Division; David Marks, Morton and Claire Goulder Family professor of civil and environmental engineering and engineering systems, MIT, Engineering Systems Division; Dava Newman, professor of aeronautics and astronautics and engineering systems, MIT; and Richard de Neufville, professor of civil and environmental engineering and engineering systems, MIT.

Dan Roos
Director
Japan Steel Industry Professor of Engineering Systems and Civil and Environmental Engineering

More information about the MIT–Portugal Program can be found at http://www.mitportugal.org/.