

## MIT Portugal Program

The [MIT Portugal Program](#) (MPP) is a strategic international partnership among Portuguese universities and research centers, MIT, and the Portuguese government. The program has built interactions and collaborations with a collection of industrial partners that contribute in multiple ways. Program funding is provided both by the Fundação para a Ciência e Tecnologia (FCT, the Portuguese Science and Technology Foundation) and by a number of industrial partners. The goal of MPP, launched by the Portuguese government in 2006 and renewed in 2013, is to strengthen the country's knowledge base and international competitiveness through strategic investments in people, knowledge, and innovative ideas.

As of 2015, MPP is hosted by MIT's Institute for Data, Systems, and Society (IDSS). In 2015, the program leadership passed to Professor Bruce Tidor from Professor Dava Newman, who took over from MPP's founding director, Professor Dan Roos. To date, the program has enrolled more than 780 students in Portugal, supported about 200 MPP students and scholars at MIT, and involved 270 faculty in Portugal as well as 80 faculty and 30 staff researchers at MIT. MIT faculty and research staff come from departments in all five of the Institute's schools. Broad institutional engagement, support, and expertise have played a significant role in the success of the MIT Portugal Program.

During its first phase (2006–2013), MPP focused on the internationalization of Portuguese universities in four focus areas: bioengineering systems, engineering design and advanced manufacturing, sustainable energy systems, and transportation systems. The well-designed efforts and programs of the first phase enabled Portuguese universities to overcome long-standing patterns of isolation and competition by encouraging inter-university cooperation through joint partnerships with MIT, subsequently facilitating a build-up of critical research mass in priority areas. Moreover, MPP has contributed to the strengthening of innovation and entrepreneurship at Portuguese universities through a variety of activities—from venture competitions to entrepreneurial education—as well as contributing to significant higher education reforms in Portugal. The first phase of MPP led to the construction of innovative curricula across Portuguese partner universities by adopting best practices from MIT and input from Portuguese universities and stakeholders. Portuguese universities involved in MPP offered doctoral programs and advanced courses in the program's four focus areas to future leaders in technology and innovation. MPP contributed to the formation of a wider community of affiliated Portuguese universities and to collaborations with MIT, industrial partners, innovators, and entrepreneurs from within Portugal and around the world. These changes helped generate hundreds of scientific papers and contributions to international conferences. MPP, through the support of FCT, has successfully funded more than 20 research projects; enabled the creation of more than a dozen start-ups by students, graduates, researchers, and faculty; and achieved visible impact and significant cultural change within Portugal and beyond.

In its second phase (2013–2017), with a reduced budget, MPP will concentrate on a smaller set of key objectives, including support of a higher education ecosystem directly connected to technology development and innovation; promotion of a

thriving relationship among graduate students, faculty, and industry experts through collaborative projects; and further development of transdisciplinary innovation and entrepreneurship activities. These objectives aim to maximize knowledge transfer and the translation of technology-based ideas into economic value through a combination of individual drive, basic research, technology innovation, entrepreneurship, industry-academia collaborations, and the successful integration of highly educated innovators into the workforce. A goal of this second phase is to make teaching activities self-sufficient and focus MIT's input on research, innovation, and hosting and co-supervising students at the Institute, in order to provide students with a rich experience in the MIT ecosystem.

The second phase focuses on improving the innovation ecosystem; developing and fostering integrated research activities in joint university-industry partnerships; and projects intended to create value and contribute to sustainable economic growth through the development of new knowledge-based products and services. This effort is supported by new mechanisms for joint university-industry research at the national and international levels through seed and test-bed projects.

Test-bed research projects are designed as partnerships that include universities, public institutions, industry, and other private organizations. These highly collaborative and integrated projects are strongly supported by funding from FCT and contributions from private-sector test-bed collaborators for a duration of up to three years and with the objective of developing innovative technologies leading to new products and services that can advance Portugal's international competitiveness and innovative capacity, ultimately contributing to the growth of the country's economy. These large-scale test-bed projects are complemented by exploratory seed projects fostered through smaller grants. MPP researchers have successfully attracted industry and other private and public partners, significantly contributing to the support and funding of the test beds. Corporate research partners and companies involved in MPP's innovation and entrepreneurship activities have formed the core of a community that is being engaged in the program's Industrial Advisory Committee.

The MIT Portugal Program has successfully advanced the internationalization of Portuguese universities through an increasing number of MPP international students and graduates. To date, MPP has received 3,110 PhD student applications. The program attracts many students from outside Portugal; international applicants average about 50% of students and come from more than 20 nations. Overall, MPP has enrolled more than 780 PhD and master's students at participating Portuguese universities, and more than 350 of these students have graduated since the start of the program. As the number of successful MPP graduates has grown, the program has taken significant steps toward the development of an alumni network, which represents an important asset facilitating MPP's long-term societal and economic impact. Alumni have been connected to MPP through several social media platforms that have been deployed for surveys.

A particularly noteworthy achievement was the recruitment of two MPP innovation professors to universities in Portugal that participate in the program. Working jointly with MIT, these new professors are developing plans to enhance the

innovation ecosystems in their universities and across Portugal. Together with the successful transfer of educational programs and other steps, MPP has made significant advancements in sustaining and growing its activities in innovation and entrepreneurship.

Over the years, MPP has become a widely known success and a role model for multi-stakeholder alliances involving universities, industry, governmental agencies, and international partners with the goal of increasing international competitiveness by fostering skill and knowledge creation and exchange, leading to innovation, entrepreneurship, and societal impact.

## **Program Highlights**

### **Education**

MPP offers a transdisciplinary curriculum in PhD and master's programs across its four focus areas (bioengineering systems, sustainable energy systems, transportation systems, and engineering systems). During the last two calls for graduate student applicants, more than 900 applications were received for the MPP doctoral and master's programs. In 2014–2015, more than 35 PhD and master's students graduated from the different programs. MPP has successfully engaged the program's growing alumni community and conducted a survey among PhD graduates that provided valuable information about their professional development and experiences. MPP has initiated a similar survey directed toward master's program graduates. Since 2014, approximately 50 PhD students have been hosted at MIT, where they have carried out part of their thesis research. MPP students at MIT benefit strongly from exposure to new methodological approaches, cutting-edge research, and entrepreneurial ideas. MIT faculty have hosted nine Portuguese scholars over the same period, further enhancing already strong ties among MPP faculty and fostering continued exchange in research and educational and entrepreneurial models.

### **Research**

As noted, in the second phase of the collaboration, MPP has introduced large-scale test-bed projects that address research topics in a holistic fashion through integrated, multidisciplinary approaches. A first call for test-bed projects identified three projects for funding in three different research areas: SusCity (Sustainable Cities; led by John Fernandez), CardioStem (Stem Cell Engineering & Regenerative Medicine; led by Robert Langer and Jeffrey Karp), and IAMAT (Introduction of Advanced Materials Technologies; led by Brian L. Wardle). Two of the three projects have begun, with advanced research and collaboration between industry and academic partners. The final approval and start of the third project, IAMAT, is expected in late 2015.

In addition to the test-bed projects, six seed projects were selected for funding at MIT:

- Urban Data Driven Models for Creative and Resourceful Urban Transitions (led by Marta Gonzalez)
- Economics of End-of-Life Recovery: Consumer Electronics Case Study (led by Elsa Olivetti)

- Protein-Based Polyurethanes (led by Bradley Olsen)
- Autonomous and Cooperative Urban Mobility (led by Carolina Osorio)
- The Tunable Rheology of Colloidal Gels: How Fluid Physics Impacts Soft Materials (led by James Swan)
- Modeling the Value of Storage for Intermittent Renewable Energy (led by Jessica Trancik)

Seed projects were introduced to stimulate and foster novel, early-stage research that could be synergistic with research in test beds or could enhance MPP in other ways, such as by increasing the impact, sustainability, and visibility of the program; stimulating activities in innovation and entrepreneurship; exploring potential new directions; and fostering the development of educational materials or tools.

In addition to test-bed and seed projects, a number of MIT faculty and researchers, including Richard De Neufville, Herbert Einstein, Stan Finkelstein, Paula Hammond, John Heywood, Richard Larson, Kristala Prather, Leia Stirling, Joseph Sussman, and Chris Zegras, greatly supported MPP in all of its programmatic and functional areas.

### **Innovation and Entrepreneurship**

MPP was able to attract two “innovation professors,” Nuno Arantes-Oliveira and João Bigotte, within the program’s Technological Change and Innovation Initiative. Both have begun to make critical contributions to MPP’s efforts toward sustainability of program activities. Together with these two new innovation professors, MPP put in motion an additional approach to industry engagement through area-specific academia-industry roundtables, which aim to connect MPP faculty and students to industry players. The innovation professors will also reinforce MPP’s unique approach to the introduction of innovation into its curricula. This innovative approach has increased the entrepreneurial activities of MPP students and graduates, including the establishment of companies such as doDoc and Mater Dynamics. In an effort to continue the stimulation and facilitation of entrepreneurial activities in Portugal, MPP engaged Portuguese start-up companies through different channels, including the Building Global Innovators program, educational programs and workshops, and direct interactions with companies and innovation hubs. In 2015, the first International Workshop on Innovating took place at MIT with international students from different nations, including MPP students. This workshop is a weeklong immersion into novel ways of understanding how to innovate. Innovations solve real-world problems, and their impact transcends the object and the organization innovators build. MPP has also engaged with industry through research collaborations and has formed an Industrial Advisory Committee.

### **MIT International Science and Technology Initiatives Portugal Program**

The MIT International Science and Technology Initiatives (MISTI) program officially incorporated a program in Portugal in August 2014. The first eight MIT students traveled to Portuguese companies, research institutes, and universities during the summer of 2015. MPP kick-started the MISTI Portugal Program with initial funding. Expenses were fully or partially covered by Portuguese companies for their visiting intern students. MISTI and MPP covered the costs for students who visited universities

and research institutes. In the future, MISTI is considering a collaboration with the International Research Opportunities Program (IROP) that might provide funds to undergraduate students who intern at research institutes or university labs in Portugal. Alicia Goldstein-Raun, managing director of the MISTI Spain and MISTI Portugal Programs, coordinated the application and placement process. Application procedures were defined in accordance with MISTI time lines and requirements. Priority was given to MPP-associated companies and institutes.

## **Events and Outreach**

Each year MPP hosts a number of high-profile events, both at MIT and in Portugal, to promote research, education, and innovation and to help foster MPP student and researcher interactions with industry and the public. Selected events are highlighted below.

### **MIT Portugal Program Annual Conference**

The fifth MPP annual conference was held on June 19 at Reitoria da Universidade Nova de Lisboa. The theme was “Light: Designed by Nature, Transformed by Science,” and the event featured a range of speakers from Portuguese universities, industry partners, and MIT. Conference sessions included:

- Science Transforming Our Lives
- Shaping Future Cities—The Challenge of Sustainable Urban Ecosystems
- Designing by Nature
- New Horizons—Lighting the Unknown

The conference was hosted by Manuel Heitor, director of the Center for Innovation, Technology and Policy Research at IST Lisboa; Bruce Tidor, MPP acting director at MIT; and Paulo Ferrão, MPP director in Portugal. A wide range of MPP faculty, students, alumni, and industry partners contributed to the conference through presentations and discussions. As in previous years, the conference also included a poster session highlighting contributions from MPP PhD students and ongoing research projects as well as the annual graduation ceremony for recent MPP PhD and master’s graduates.

### **Portugal Life Sciences Mission**

Robert Sherman, the US ambassador to Portugal, organized the Portugal Life Sciences Mission, which took place in June 2015 in Lisbon, Coimbra, and Porto. The goal of this event, chaired by Nobel Prize winner Craig Mello, was to build and strengthen interactions between Portuguese and US universities, biopharmaceutical companies, and investors. The mission attracted a high-level delegation of life science and pharmaceutical executives, researchers, investors, and entrepreneurs from across the United States and Europe. MPP team members supported the preparation of the mission and attracted representatives from pharmaceutical companies to the event. Dr. Stan Finkelstein from MPP also took part in the mission.

## **Fostering Science and Innovation Ecosystems**

The International Partnerships Program, which is funded by FCT, held its first Fostering Science and Innovation Ecosystems joint conference and exhibition at the Palácio Foz in Lisbon on May 28 and 29, 2015. This high-profile event brought together Portugal's major international partnerships. The event aimed to showcase the activities and outcomes of the partnerships with Portugal and to reflect on lessons learned.

## **Engineering Design Roundtables**

The aims of the Engineering Design Roundtables series are to exchange ideas on critical issues that will foster cross-cutting and transdisciplinary competencies in engineering systems and to explore solutions to complex industrial problems through project-oriented and project-based activities. In order to achieve these objectives, the roundtables bring together doctoral students, researchers, and experts from industry and government to discuss new frontiers in product development, new technical developments, and project-based activities. The MIT Portugal Program, through the Engineering Design and Advanced Manufacturing Initiative, is an institutional sponsor. Over the past year, roundtable sessions focused on challenges in engineering design in aeronautics (February 2015) and new frontiers in technology development (March 2015).

## **Visit by the Portuguese Minister for Economy**

The Portuguese minister for economy, António Pires de Lima, visited MIT on December 12. The minister was accompanied by Leonardo Mathias, deputy secretary of state for economy; Pedro Gonçalves, deputy secretary for innovation, investment, and competitiveness; and Luis Castro Henriques, administrator of the Agency for Investment and Foreign Trade. The delegation met with regional entrepreneurs and company representatives to foster ties in research and innovation. While in Cambridge, the minister and his delegates exchanged ideas with Portuguese companies and US investors at the Cambridge Innovation Center. The minister also visited MPP headquarters at the invitation of program director Dava Newman, who was joined by the program's focus area leads and researchers from MIT. Minister Pires de Lima stressed the "great level of satisfaction" with the partnerships between Portugal and US institutions, with the MIT Portugal Program being of central importance. Pires de Lima explained how Portugal's partnerships with MIT and other leading institutions in the United States have contributed to the formation and training of a new generation of leaders who will help Portugal be more competitive in a knowledge-driven economy. He commended the program for fostering knowledge that is directly applicable to industry and businesses, pointing to the many start-ups launched in technological areas. He also emphasized how such international programs represent a significant investment of the Portuguese government in graduate education.

## **Fostering Transatlantic Growth of Marine Renewables**

Portugal and the United States joined efforts to organize the annual WavEC "Fostering Transatlantic Growth of Marine Renewables" seminar, held in October 2014. As a result of new technologies and prototypes, marine renewables are moving rapidly toward commercialization. Portugal is a leader among European countries in the development of renewable energy, especially offshore floating wind. Developing strategies that focus

on industrialization, cost reduction, and improvements in performance and reliability is of chief importance. Experts from the United States, Portugal, and Europe, including representatives of MPP, spoke at the seminar.

### **Advanced Training and Industrial Research for Complex Engineering Systems**

The Advanced Training and Industrial Research for Complex Engineering Systems task force, promoted by the MIT Portugal Program, CEIIA, and other groups, aims to build capacity through industrial research and expert competence building. The group's main emphasis is on industrial aeronautics, with potential applications in other areas of complex engineering systems, including oil and gas field services and urban systems. It is a project-based initiative focused on the north of Portugal and on capacity building at CEIIA. It is expected to foster and promote new industry-science relationships involving end users, technology-based firms, and academic research groups. The task force met in July 2014 to discuss current and future projects.

### **Global Visibility and Recognition**

In an independent assessment, the Finnish National Academy recognized the MIT Portugal Program and its Portuguese sister collaborations as an excellent and commendable initiative, interesting to the entire European research area. The assessment labeled the program a “model of good practice” and applauded its many successes, including national collaborations, internationalization, and attention to quality. The academy found MPP to have a solid success record with regard to the goals of collaborative research projects: excellence in teaching and training, and effective commercialization/entrepreneurship.

From its inception, MPP has strived to become a model international program in which innovative research and educational initiatives from around the globe combine to address some of today's greatest technical, economic, and social challenges. The program has been both the driver and the result of important ongoing reforms of the Portuguese higher education system.

Managing and measuring the success of complex multiparty alliances, which aim at societal impact by employing unique, experimental measures adapted from best practices at leading institutions, has become an important area of research at MIT and in MPP. A particular focus of this research is on the analysis of early indicators of impact, since validated performance indicators that can be linked to long-term program effects have not been established as a result of the heterogeneity of approaches pursued by different programs and the limited applicability of historical data from institutions that have grown over many decades. Research conducted within MPP has compared different partnership architectures and continues to analyze the impact of the program on academic research in Portugal, which will contribute to discussions regarding the design of future international programs at MIT.

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