Founded in 1861 as a land grant university dedicated to supporting the industrial revolution, the Massachusetts Institute of Technology is proud of its long and fruitful relationship with industry.

Today, it leads the way in developing innovative approaches to industrial R&D investment and collaboration, including consortia and "mutual-fund" type research portfolios.

ABB has a long history of engaging in research activities at MIT both as the sole sponsor of projects and as a co-sponsor of larger consortia activities. Together, MIT and ABB are forging creative solutions for many important problems.

The MIT experience

MIT – a wellspring of technological advances for global industry

Eric Brown

The Massachusetts Institute of Technology has always enjoyed a close relationship with industry. To illustrate this, in fiscal 2004, almost $83 million of MIT's $529 million in yearly on-campus research volume was funded by industry, making it one of the top two U.S. universities in industrial investment both in dollar amount and percentage. Total corporate investments grew 55% over the last decade to almost $170 million, including $40.7 million in corporate grants and $36.1 million in licensing fees. Currently over 160 companies spend over $100,000 a year at MIT.

Today, companies seek out MIT researchers for more than first-rate electrical and mechanical engineering expertise. MIT is frequently the source of breakthrough discoveries in information technology, imaging, biotechnology, nanotechnology and many other fields. Not surprisingly for a university that has sponsored 57 Nobel Prize winners, several of MIT's 35 departments and divisions are ranked in the top one or two in the U.S. Many more, including its Sloan School of Management, are ranked in the top five. The School of Engineering is widely considered to be the best in the world.

In recent years two of the most popular forms of R&D investment at MIT have been consortia funding, in which companies pool funds toward a particular research goal, and portfolio investing, in which companies or consortia fund a set of programs or research projects as part of a broad engagement. Both trends also reflect a growing interest in MIT's interdisciplinary research efforts, as consortia and portfolio R&D investments often target either specific interdisciplinary labs or fund a cross-section of interrelated areas of research.

Whatever the mechanism for involvement, corporations are drawn to MIT in order to expose their management to insights from MIT's internationally-recognized experts. Working together with MIT, companies are able to accelerate the development of new products, processes, and growth strategies while recruiting future leaders.

Thanks to the quality of its faculty, MIT can afford to focus on developing those issues that will have the greatest impact on industry and society. This applies both to basic research, which

is often instrumental in solving important problems several decades in the future, as well as more applied research that delivers more immediate benefits.

According to MIT's Past President Charles Vest, "The continuing rise in collaborative relationships between MIT and corporations is based on a synergy of basic research efforts and long-term commitments by industry."

In addition to the large volume of basic research done on campus – 74% of which is funded by the U.S. Government – MIT is also a wellspring of practical technological solutions, discharging a steady flow of patentable ideas that evolve into profitable commercial ventures. In fiscal 2004 alone, MIT research was responsible for the disclosure of 510 new inventions, 287 patent applications, and 94 issued licenses. A 1997 BankBoston Study showed that 4,000 active companies around the world were founded by MIT graduates or faculty, and were responsible for over 1.1 million jobs and $232 billion in annual world sales. Many billions more are generated by companies whose technologies are based upon MIT R&D investments.

One such company which has stood out as a leader in developing innovations in R&D investment and collaboration with MIT is ABB. Thanks in part to its partnership with MIT, ABB is forging creative solutions for important problems such as creating a self-healing power grid and developing efficient, ergonomic automation equipment for the process and utility industries.

Flexible approaches to R&D investment

MIT offers a diverse set of business models for interaction with industry, from decentralized engagements to specific bilateral arrangements to institutional investment. Over 700 companies are financially engaged with MIT in one way or the other, whether in a consortium, investing in individual projects or sending employees to technical and executive education programs.

Much of the interaction between industry and MIT researchers is facilitated by the 175-member Industrial Liaison Program, which is run under the Office of Corporate Relations (OCR). With $8 million in funding and a 45-person staff, the widely-imitated ILP is the largest program of its kind. It has played a key role in MIT's success in linking corporations such as ABB with relevant on-campus research efforts.

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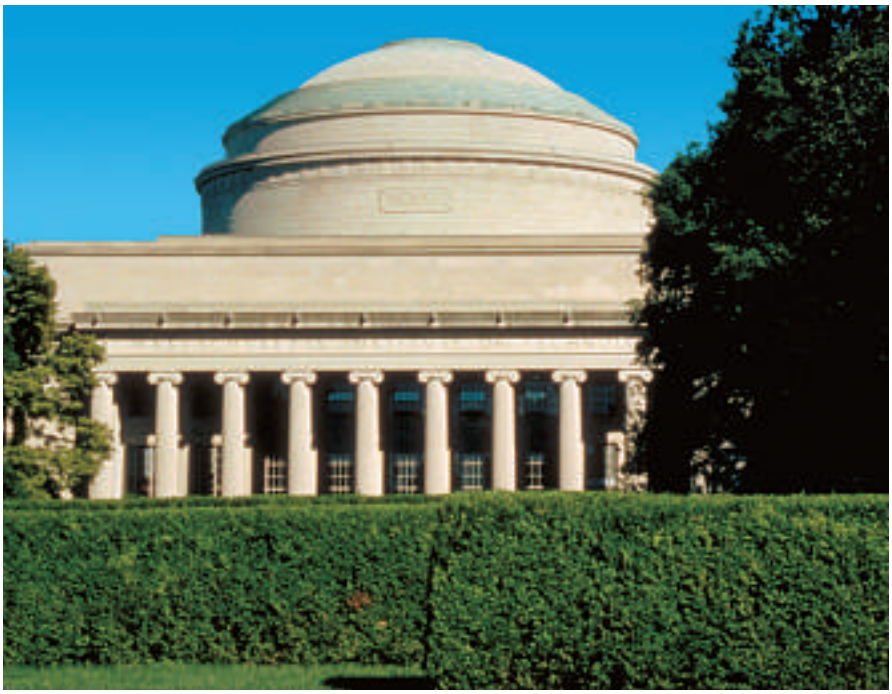
Karl Koster, Director of the OCR says that the ILP facilitates the process of getting a dialog going. "We organize one-on-one meetings on campus for member firms with MIT faculty members and we go out and find the faculty who are relevant to a company's interests." Each member company is assigned an Industrial Liaison Officer who represents the firm at MIT and can not only arrange private talks with faculty but also coordinate an annual private research briefing for a larger group from the member company. Another popular way to identify research opportunities is by attending one of the many seminars and conferences hosted by ILP every year. Of special interest in 2005 is the R&D meeting in November and the Energy Conference in December.

In addition to individual research investments at MIT, companies are increasingly pooling their money in research consortia to address topics of common interest that are often pre-competitive in nature. For example, the MIT Media Laboratory brings companies and academics together for interdisciplinary research on digital media technology and impacts. Funded on a fee basis, the Media Laboratory shares pre-publication results with all its members.

MIT consortia often play key roles in the definition of industry standards. Examples include MIT's recently concluded Auto-ID Center consortium, which united companies to develop the Electronic Product Code (EPC) for Radio Frequency ID technology. The EPC technology is now being further developed by a spinout company called EPCGlobal, and it is well on its way to becoming an industry standard.

Perhaps the most significant standards work performed at MIT over the last decade has been accomplished by the World Wide Web Consortium (W3C). The W3C is now spearheading new protocols for Web Services as well as promoting its Semantic Web protocols to pave the way toward a smarter, more collaborative future version of the Web.

Koster says that companies work with MIT because they want a deep understanding of the standards and technology platforms that are going to be important to their products. He adds,



"By coming together in a neutral setting, they can also influence the development of future standards."

Another growing trend is a portfolio approach to R&D investment in which a company funds a set of programs, consortia or individual projects. This, according to Koster, is somewhat analogous to mutual funds in that companies, such as ABB, are applying a portfolio approach to look for advances in technologies that are relevant to their business strategy.

An MIT program that engages in this approach is the Leaders for Manufacturing (LFM) Program (see following article on page 18), a partnership of MIT's School of Engineering, Sloan School of Management and corporations including ABB. Dedicated to manufacturing issues such as product development and supply chain strategies, LFM offers a portfolio of cutting-edge education and research programs. In addition, participants benefit from contact with the future manufacturing leaders who participate in the program's dual-masters degree and often intern with member companies. Since 1999, ABB has sponsored two to three LFM interns each year, and has hired a total of 16 for fulltime positions.

At the most ambitious level of collaborative investment, MIT has established a set of corporate partnerships, typically multi-million dollar, multi-year agreements that focus on strategic areas of interest. These include long-term partnerships with Dupont, Microsoft, and the Ford Motor Company. These agreements involve management teams of upper level executives from both the company and MIT. Together they determine the direction of the partnerships and the focus of investments, including research projects, internships, and executive education.

Who owns the technology?

Under the Bayh-Dole Act of 1980, the U.S. government allows universities to take ownership of patents developed by their faculty under government grants. MIT, like most universities, also takes title to Intellectual Property (IP) developed using MIT facilities or funds or which was developed under grants from other organizations. MIT's Technology Licensing Office (TLO) is charged with prosecuting, maintaining and licensing IP from MIT as well as its two associated institutions, Lincoln Lab and the Whitehead Institute.

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MIT policy requires that all research results must be publishable. However, when companies fund research, they are given a short review period during which time they can request that patents be filed. Commercial sponsors receive options to acquire licenses to the technology developed at MIT under their sponsorship.

MIT's primary mission is to encourage commercial investment in its early stage inventions to get the technology commercialized for public benefit. With these goals in mind, the TLO often grants exclusive commercial rights to companies that commit to significant investments in a technology. According to Lita Nelsen, TLO's Director, MIT is not trying to maximize its financial return on IP but is instead – with the help of its IP model – trying to get the technology developed and out to the public.

This flexible IP model also offers advantages to faculty members. "A lot of our faculty members would be reluctant to promote and market their technology on their own," Nelsen says. "They don't want to spend the money to get the patent, and they often lack the expertise to develop the connections."

Although faculty - and graduate student inventors - may not own the technology they develop or negotiate terms, they earn a third of the net royalties that MIT receives from their inventions. If the IP has been developed under government funding and/or when a commercial sponsor chooses not to take a license, inventors may acquire licenses to launch spin-off companies based on their inventions.

Who directs the research?

MIT faculty members are encouraged to actively pursue investments in their research. Faculty must seek out investments from corporations as well as apply for grants from government organizations such as the U.S. Department of Energy and the National Science Foundation.

Koster says that when faculty members believe in the importance of their work and find someone to fund it, this helps keep MIT research focused on real-world solutions. "The level of corporate support at MIT is a testa-

ment that many of the faculty are working on things that have a real impact in a commercial and societal sense," he adds.

Although the ILP is active in helping faculty and industry find each other and start a dialog, it steers clear of negotiating the scope of the research. The degree to which a given research direction veers into the practical versus the theoretical, or the near-term versus the long-term, is mutually decided between the researcher and the investor.

MIT researchers tend to perform at a level at which they are inclined to think big, and MIT encourages that perspective. Koster points out that the faculty won't do something that's not of interest to them. "They're focused on the leading edge and are looking primarily at basic research. If it doesn't advance the state of the art, it won't advance their careers. But a company won't support it if it doesn't see any benefit, so they have to come to a mutual understanding."

MIT faculty members have another incentive for working with industry that falls outside research investment opportunities. One day a week they are free to pursue independent professional activities, including consulting.

The consulting arrangements not only generate extra income for faculty but they also help to build relationships for future investments. Whether through consulting or collaborative R&D investment relationships, the ability to share information and work side by side with industrial colleagues adds value to both sides of the relationship.

An interdisciplinary powerhouse

In today's science and engineering laboratories, some of the biggest breakthroughs occur in cross-disciplinary efforts. MIT is not only ideally suited for this new reality, but is actively pursuing it in its 158 interdisciplinary labs and research groups. Corporate R&D partners are keen on harnessing this interdisciplinary power, hoping to develop future products.

Some of the potential products that could emerge from current MIT interdisciplinary work include cell phones powered by photosynthetic solar cells, wristwatches that sample a patient's blood for potential cardiac problems, to nano-engineered 3D scaffolds that mimic the function of human tissue, and ant-like robots that target landmines.

One of the keys to MIT's cross-disciplinary success, says Koster, is consistent excellence across departments. "Faculty members are very comfortable working with colleagues in other departments because everybody's at the cutting edge. This breadth has fostered a degree of interdisciplinary work that is uncommon."

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Some of this integration is happening at the institutional level. Last year, for example, the MIT Artificial Intelligence Lab merged with the Lab for Computer Science to become the Computer Science and Artificial Intelligence Lab (CSAIL). A unifying program within CSAIL is Project Oxygen, which encompasses a vision of networks of pervasive mobile computing systems that use multi-modal input devices to aid and anticipate human users in their everyday tasks.

One of Project Oxygen's core technologies is Cricket, one of many related wireless sensor networking technologies at work in various projects scattered about the University.

When ABB's Chief Technology Officer, Markus Bayegan visited MIT recently he was interested in wireless sensor networking. The ILP gathered together researchers from five departments to meet with him, discuss their related research, and explore the possibility of working together with the company.

This briefing, according to Cynthia Bloomquist, Industrial Liaison Officer for ABB, is an example of how the ILP can help bring disparate interdisciplinary units together with potential corporate investors in faculty meetings.

ABB and MIT: A model for collaboration

Reaching out to the world's top-ranked research institutions is a key to ABB's leading edge approach to knowledge acquisition together with internal R&D, joint ventures, and acquisitions. Working with institutions such as MIT, ABB has found it can successfully invest in and extract knowledge and feed these resources into its technology strategy.

ABB has a long history of engaging in research activities at MIT, both as sole sponsor of projects and as a cosponsor of larger consortia activities. ABB has actively invested in MIT research in chemistry, corrosion, software, and sensors and controls to wireless networks, involving CSAIL as well as the Chemical, Nuclear, Mechanical, and Electrical Engineering departments. Its participation in the Industrial Liaison Program sets the stage for other involvements, providing facilitated access to the faculty and their expertise.

ABB has participated in the LFM Program and was a founding sponsor of the Alliance for Global Sustainability, where it worked on the design of advanced boiler systems for power generation together with MIT and Chinese academic and governmental officials. Koster says this particular collaboration was "effective for ABB in educating the Chinese government officials around some of the issues related to energy generation and product design."

As a company that has a major impact on some of the world's most pressing issues, ABB is of special interest to MIT faculty. As MIT and ABB together work to develop new and more innovative approaches to R&D, both sides benefit equally.

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