ERDMAN CENTER

Erdman Center for Manufacturing and Technology Management

Manufacturing and Technology Matters

University of Wisconsin-Madison School of Business

Fall/Winter 2003

Making Research Happen: The Role of Universities

The Educational-Industrial Complex

The research conducted in universities has been instrumental in providing new technologies and products for industry. Intellectual property management and commercialization of research has facilitated industrial and economic growth. Over the last 10 years, a new innovation system has evolved in the U.S., based on basic research in universities, nurtured by rapid growth in venture capital (up 73.5 percent in 2000, to $103.0 billion, according to the National Venture Capital Association), and implemented by industrial firms. This highly complex system of innovation is based on close collaboration and increasing use of alliances among industry, universities, and government labs.[1]

The key element of the equation that has changed the American research university from being a "provider of standardized educational services and public goods" to becoming the "key component in the national economic infrastructure" is the economic power obtained through new technologies developed in the educational sector. Typically, these technologies have emerged from university research and moved out into industry and lead to the development of new products and processes. Such results have spurred the creation of new firms and even new industries, have brought old industries down, and, in general, have profoundly impacted rates of industrial innovation.[2]

The volume of patents by the university sector, while still small relative to industry, has increased substantially in the last 30 years in absolute numbers of patents. Moreover, it has increased more quickly than the overall trend of patenting in the U.S. and the number of patents assigned to universities per research dollar spent at universities has more than tripled. This increase in universities' "propensity to patent" is due both to an increase in the number of patentable inventions and to a general decline in the threshold of university standards for patentability. The latter phenomenon likely reflects the large influx of patents from the many smaller institutions with generally weaker research programs and less experience in patenting their inventions.[3] Universities have effected technical advances through education of a skilled labor force and have actively engaged in commercialization activities through university-industry partnerships. These strong links between university and industry have driven technology transfer from research laboratories to commercial markets.

The Bayh-Dole Act created a uniform patenting policy among all federal agencies that fund research, permitting research institutions to retain intellectual property title to the material and products invented using federal funding. The flow of federal funding into academia, industry and their collaborative efforts has resulted in diverse licensed patents and products. In a study undertaken to review the economic effects of the Bayh-Dole Act, Jensen and Thursby (2001) surveyed sixty-two research universities concerning their technology transfer activities for the years 1991-1995.The results of the survey reported that the average net revenue distributions from license royalties going to the university, the researcher's department, and the faculty inventor are 35%, 25%, and 40%, respectively.

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SCHOOL OF BUSINESS
University of Wisconsin-Madison

In This Issue...

Research budgets in academia

The Wisconsin Alumni Research Foundation (WARF) facilitates the use of UW-Madison research, distributing the incomes from commercial licenses to the university, the inventors, and their departments. WARF has processed over 4,000 UW-Madison inventions and secured approximately 1,500 U.S. patents. The foundation has also excelled at moving these innovations into the marketplace: Last year, over $1 billion in products were sold under license from WARF. Of the foundation's 600 license agreements, approximately 20 percent are with Wisconsin businesses.

"Traditionally, we've had very successful relationships with Wisconsin companies, especially in the medical device industry, the high-tech start-up sector, and the agricultural sector," says Bryan Renk, WARF's director of patents and licensing. (Also see articles on p.6)

Columbia University's Columbia Innovation Enterprise (CIE) oversees technology-transfer efforts for that university. Ofra Weinberger, director of health sciences, notes that Columbia has produced more technology-licensing income than any other university in the country. The state's universities, federal labs and private companies attract $8.5 billion annually in federal research funding, outpacing every other state on a per capita basis.[4] The University System of Maryland's research institutions spent nearly $600 million on research in fiscal year 2001. The state of Virginia budgets about $10 million for the Center for Innovative Technology, its primary tech commercialization arm. Pennsylvania's Ben Franklin Technology Partners, that state's tech development clearinghouse, runs four regional centers with about $26 million. Johns Hopkins University pulls in more than $1 billion in federal research and development funding, second only to the nine-campus University of California system. Florida's universities have scored notable successes in commercializing R&D – most prominently the cancer-fighting drug Taxol. Florida ranks 4th in the nation in university royalties and license income per worker, and 11th for the number of university spin-offs per dollar of R&D spending, according to the Association of University Technology Managers.[5]

Research and equity clashes

Although the aim of most technology transfer is to commercialize technology, retain faculty and students, and promote economic growth, the goals of industry may not be in perfect synergy with those of the universities. This conflict of interests might be reflected at varied levels, hampering the speed of the development process.

The debate between companies and universities frequently revolves around whether or not to disclose detailed research findings. As a result, publications may be delayed to provide time to seek patents. Also, companies may want to reward the inventors through equity grants, while the universities do not want such actual or perceived potential financial gain to influence research. An additional stumbling block exists in the dangers associated with blocking patents. While companies would expect to be safe from their partner universities filing such blocking patents, university policies would obviate impeding one research project in order to aid a research contract. The universities would expect specific license terms to be accompanied by enforceable diligence commitments while this may not be always true from a company's viewpoint.

"Many of these technologies can create fabulous wealth for all involved and solve real problems for our society," says Mitch Mumma, general partner of Intersouth Partners, a venture capital firm in Research Triangle Park, N.C. "But too many companies stay in research mode forever and need, as part of management, people who have taken products to market. This allows the researcher to continue with basic research adding potential new intellectual property…down the road, and the [sponsor] gets to keep their star inventor." Alternatively, moving researchers and developers from the lab to the corporation can be a challenge. Narrow focus on details and overestimation of the probability of success are some of the common pitfalls. [6]

1. Larson, Charles F., R&D and Innovation in Industry, Industrial Research Institute, AAAS Report XXVI: Research and Development FY 2002.

2. Graff, Gregory, Amir Heiman, David Zilberman, Federico Castillo, and Douglas Parker, Universities, technology transfer, and industrial R&D, Vol. 45, Issue 1, November 2002, pp. 88-115.

3. ibid

4. "Boehlert, R&D leaders make case for R&D investments in New York," http://www.bcnys.org/whatsnew/2001/0516rd.htm.

5."Emerging Businesses," http://www.newcornerstoneonline.com/body_business.html.

6. Lester, Margot Carmichael,"The Promise of Technology Transfer," Larta Vox http://www.larta.org/lavox/articlelinks/2003/031020_techxfr-overview.asp, October 20, 2003.

Making the Shift from Research to Development

Exploring the theme of management of research, MTMatters looked closer at a large scale R&D project called IceCube. MTMatters believes that this project, and its predecessor AMANDA, offers some unique insights into the way that research is managed in a university setting.

The IceCube project

IceCube began as the Antarctic Muon and Neutrino Detector Array (AMANDA) project. AMANDA was the research work done to prove that IceCube would be a viable project.

IceCube is a neutrino collector currently being constructed at the South Pole. The collector is stationed 1,400 to 2,400 meters below the ice, and is made up of about 5,000 photomultiplier tubes - a vast increase from the over 400 photomultipliers used in the original AMANDA project. The photomultipliers have been designed to detect light emissions generated when a neutrino makes a rare collision with a water molecule. These emissions are detected by a number of the photomultiplier tubes, and by observing which specific tubes in the array detect the light, one can determine the source of the light, and ultimately the neutrino.

IceCube is the second largest scientific project being done by a university in the U.S. (the biggest one is the gravitational wave detector at being built at Caltech). IceCube is the product of international scientific cooperation involving 25 universities from seven countries. UW-Madison is the lead institution for both projects and the center for funding and management of the project.

MTMatters asked both the lead scientist, Dr. Francis Halzen, and project manager Andrew Laundrie to give our readers insight into critical issues surrounding the management of research and development, using the IceCube project as an example.

On the differences between research (AMANDA) and development (IceCube)…

Halzen: "If we had managed AMANDA the way we are managing IceCube, it would never have happened. AMANDA was really R&D – we changed things continuously and it was a real science project. We were inventing how to do this. It was one surprise after another and we had to adjust to it. In AMANDA we didn't produce quarterly reports as we do in IceCube today but even then we knew what everybody was doing without any formal communiqués. The difference in IceCube is that it is all documented whereas in AMANDA it was not. You cannot manage science but you can manage building scientific equipment and that's what IceCube is all about - largely a construction project based off the results of the AMANDA project."

Laundrie: "IceCube's predecessor, AMANDA, was more of a pure research project. It succeeded precisely because the scientists were given a lot of freedom to test their ideas. But IceCube is a construction project. We have a budget and a schedule that must be followed as a condition of our funding… The main difference between the AMANDA and IceCube projects has been the introduction of quality engineering. Systems engineers were brought into the projects and new policies and procedures were developed to implement the project."

On the planning and execution of AMANDA…

Halzen: "The way that AMANDA worked was that everybody did his or her own research at his or her respective universities. Once a week, and this is the key thing, we all had a teleconference. Three times a year we would all get together to plan. We had a collaboration board in AMANDA

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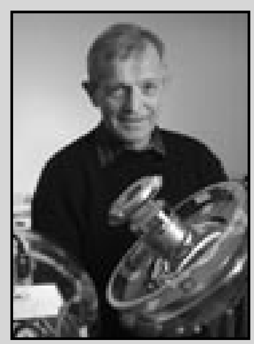


Professor Francis Halzen is the Hilldale and Breit Professor in the University of Wisconsin-Madison Physics Department. Professor Halzen's area of interest is the study of problems at the interface of particle physics, astrophysics and cosmology. He has worked on AMANDA since 1987.

Making the Shift from Research to Development *(continued from page 3)*

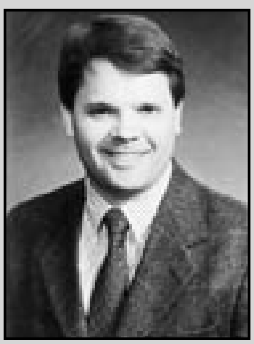
to make the formal decisions because they could not be made by 100+ researchers. The structure [of AMANDA] was very simple. There was a principal investigator, and a collaboration board.

With AMANDA [funding] was very complicated because all the funds didn't come to the UW alone. Believe it or not, we would sit in a room during collaborative meetings and the people who had the grants would figure out the budget on a big black board. We would decide whether we wanted to put three strings or six strings in the ice that year and each person would contribute a certain amount of funds. Two hours later, we would have it figured out on the board. Then the boards would be erased and everyone would have forgotten the budget but we would always end up with the strings in the ice and somehow it was paid for."

Laundrie: "Researchers from multiple institutions involved with AMANDA would send in proposals to the National Science Foundation (NSF), each of which had to have a schedule and budget attached. But that was done by people who had to make very rough guesses as to what it would take to do the work. At the other extreme, most of the people doing the work are incapable of producing a unified plan for the whole project. Project planning requires managers to sacrifice some ownership of the plan to achieve a cohesive strategy for meeting budget and time constraints."

On the planning and execution of IceCube...

Halzen: "The UW is the lead institution for IceCube and is in charge of the logistics at the Pole. We have a document, which outlines how IceCube is going to be managed, budgeted, and scheduled, and it has to be approved by NSF. We are dealing with about $42 million dollars a year and there needs to be a paper trail. For IceCube, we are currently using project management, cost, and scheduling software to help us organize the budget. In addition we have a collaboration board with weekly conference calls."



Andrew Laundrie is a Level 3 lead in the Management function at the Space Science and Engineering Center (SSEC) that oversees the construction and installation of the IceCube neutrino observatory in the Antarctic. Laundrie is a 2001 alumnus of the MTM program, and joined the SSEC upon graduation.

Laundrie: "Some of the scientists consider IceCube a continuation of AMANDA, and see it only as a scaling problem. But when you talk about a bigger organization, a bureaucracy, you have to create systems of communication and processes that everyone can follow. Also, when you bring research into production, you need the information about the failures just as much as the successes. What did fail, and how many times something succeeded in comparison to failing, is quite important to production.

The timeframes are drawn up by the Project Manager of IceCube, and the NSF reviewers determine whether they are reasonable. The thing with planning is that we never see all of the problems that lie ahead and our planning process doesn't always factor these unforeseen problems in very well. But considering that most of what we build has never been built before, our budgets and schedules probably can't get much more accurate. The law of diminishing returns applies to the amount of effort expended on planning. The key to better planning is to have better information, which is often not available."

On the motivation of scientists...

Halzen: "I must say that working with companies is a pleasant surprise because I am used to working with universities and professors. [Motivation] is more of a personal pressure than any formal mechanism. Remember, we are talking about scientists who have a goal and are a little bit fanatical about it. They are not doing this for a salary or for a 9 to 5 job. The other thing is that enormous pressure comes to bear if you are responsible for a part of the project that causes its collapse. Scientists are more motivated by their personal collaborative efforts than by reports. The reason why a managed way of doing things is better is not because scientists don't want to work. It is because they have many ideas and there is a need for convergence on one idea."

Laundrie: "I think what helps with research and creativity is not the same as what you want going into production. You need the input from scientists telling you what to build, but when they get heavily involved in design decisions and work management, it can lead to problems. As an engineer, I believe that good design and management relies more on experience and teamwork than on theoretical fundamentals. Some people who get involved in production processes may show signs early on that they do

not work well within budgeting, reporting and scheduling. Then you have to insulate them from the production phase and explain that they need to hand off the responsibilities to the production personnel."

On the indirect benefits and commercialization of research…

Halzen: "We work very closely with a lot of companies, most of whom make very little money off us. On the other hand, we provide them with some R&D. Hamamatsu had no idea that their photomultipliers would work in the cold and the ice, or whether they would work for 10 years in these conditions. When we initially requested them, they had no clue whether their photomultipliers would work at –60 °C. We took one of them and put it in a freezer. It worked even better. Thanks to AMANDA they now know a little more about their product. In addition, companies also get the opportunity to publicize their components. Hamamatsu is able to publicize in professional journals and at trade shows that "Our products are used from a hospital in NY to the South Pole."

On the differences in the way R&D is done between academia and industry…

Halzen: "There is little. For example, if you worked for Lucent, and you didn't produce results, you would get fired. Here, if you don't produce results you get your funding cut."

On the design for quick assembly at the installation site…

Laundrie: "Typically, the people who are doing the installation are young physicists who are willing to go down there (the South Pole) for three months at a time and do research under harsh conditions. So there is some emphasis on making the design simple and easy to install at high altitudes, in very dry conditions, with half the oxygen that you normally would have. The design should be intuitive and require little thought. The physicists themselves know that things are a lot harder to figure out at the South Pole – so we try to design things here so that assembly is as routine as possible. For example with a connector, how do you know whether there is sufficient torque on the connector to be properly connected? The ideal is to have a torque wrench with some sort of an indicator that it has been done properly, rather than rely on numb hands to determine whether the connector is properly connected."

On the logistical challenges of transportation to the South Pole…

Laundrie: "In this environment, when you get a group of people to discuss these things such as risk, it seems that you get factions going which say that as long as a part survives burn-in in the production area, then it doesn't matter. They will reinforce the idea that low temperatures are good and that the South Pole is a benign environment for electronics. But they neglect to note that in the transportation all the parts are put on boats and planes and are subjected to wide variations in temperature and all kinds of vibrations. And that's where the failures occur. And so some parts are put in the ice that may be very close to failure already and then they are frozen in the ice and can't be taken out when they fail. So if this faction is not willing to have that discussion and have someone actually chart out failure modes, then we have a problem."

MTMatters: How has the MTM program assisted you in your work in the IceCube project?

Laundrie: "Apart from the exposure to general business management principles, I found Management Accounting to have been especially useful to my work in the IceCube project. I also found the insights presented in [Erdman Center Director] Urban Wemmerlöv's course on the Management of Technological Change very important to the manner in which I approach my work, even though I have not reached a level where I can put many of those insights to work."

Focus on a Board Member

Bryan Renk
Director of Patents and Licensing
Wisconsin Alumni Research Foundation
Madison, Wisconsin

Bryan Renk is currently the Director of Patents and Licensing at the Wisconsin Alumni Research Foundation (WARF) in Madison, Wisconsin. He joined the Foundation in 1995 as a Licensing Manager specializing in agricultural and biotechnology licensing in addition to covering a broad range of intellectual property including medical and pharmaceutical technologies. Currently, WARF has in excess of 3,700 intellectual property cases under management coupled with over 600 active license agreements. This includes a start-up company portfolio numbering 24 companies. Bryan is also a member of the Board of Directors for WiSys and serves as its Vice President. WiSys is a wholly owned subsidiary of WARF that handles the technology transfer duties for all of the UW System campuses outside of UW-Madison. Bryan is a graduate of the University of Wisconsin-Madison where he earned his Bachelor of Science and a Master of Science in meat and animal science and muscle biology/business. He is also currently active in the Association of University Technology Managers (AUTM), the Licensing Executive Society (LES), the Wisconsin Biotechnology Association, and is on the Board of Directors for MapleLeaf Farms. He joined the Erdman Center Industrial Advisory Board in March 2003.

What was the rationale for setting up WARF? Are there other "WARFs" on other campuses?

In simple terms, Prof. Harry Steenbock in 1925 wanted a mechanism to protect intellectual property that would also be able to license and then return the proceeds to the University to support basic research There are other foundations at other campuses, around 30, but they do not all operate the same. They also did not start in 1925 with a very large success like Vitamin D.

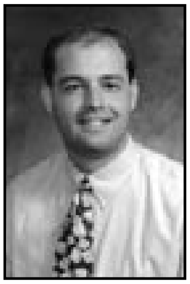
What percent of the patents actually generate money? How are the funds distributed?

At this point I would say on a crude basis about 30 percent. Last year, our royalty income was at $38,700,000. Distribution is based on the policy from the Graduate School of the University and also federal law. Simply put, 20 percent goes to the inventor group and the rest is distributed between labs, departments, and the University.

What does WARF see as its "product" and how does WARF manage this product as opposed to someone who manufactures cars or electronic components?

Our product is the claims of the patents. Sometimes it is other intellectual property, but the vast majority is by patent. We are looking for the broadest claims possible, while having the claims be as marketable as possible. These are not always the same. In addition, unlike industry, we cannot do defensive patenting because our goal is to license and have active commercialization of the technology.

MTM Alumni — Where are they now?



Mark Mulligan
(MTM 2000)
UW-Madison Space Science
and Engineering Center (SSEC)
Madison, WI

What is your current job?

Currently, I am the Project Manager of the Enhanced Hot Water Drill (EHWD). It is part of the larger IceCube project (see previous article). As the EWHD Project Manager, I am responsible for the design, assembly and test of the drill system to be used to install the IceCube.

The construction of the drill system will occur over the next two austral summers at the South Pole. The goal for this year has been to ship out a large hose reel, a tower and over 8,000 feet of hose. The hose reel and tower would be assembled and the hose spooled onto the reel. Our testing has progressed slower than planned and only reel will be shipped to the South Pole this year. A team of five engineers and technicians from the UW will be going to the South Pole to build the reel this January.

What was your first position upon graduation from the MTM program?

My first position was as the lead of a proposal team. The purpose of the proposal was to build an instrument to be installed on the International Space Station to gather unique data on the ice water content and particle size of ice clouds. This data would provide valuable information for atmospheric modeling. During the Phase A study, a more in-depth and detailed proposal was prepared and submitted. This was followed up with a site visit by a team of NASA reviewers. We felt the site visit had gone very well. Unfortunately, before two of the five Phase A studies were selected for continued funding, NASA's budget was reduced. The experience was very valuable, but just had an unfortunate ending.

What future goals do you have?

Perhaps the best part of this current position is that is has provided me with an opportunity to continue to work with two other MTM graduates - Andrew Laundrie and Don Lebar. At this time, my current goals are to complete the testing the EHWD system which should be completed sometime this spring and then explore other opportunities at Space Science.

How do you think the MTM program has helped you in your career?

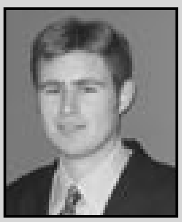
I think the internship at Harley Davidson was very valuable. It provided an opportunity to gain experience at an organization that has a unique and strong culture. I thoroughly enjoyed the internship. Of course, I enjoyed Urban [Wemmerlöv's] class on Managing Technological Change. Any organization that continues to be competitive goes through some change processes and during your career you are inevitably going to experience it. I believe Urban's class provides you with a strong understanding for how the process should go and what elements need to be present to ensure a successful change process.

Knowing what you know now, what advice do you have for your fellow MTM students?

I guess if I were to pass on any advice, it might be to take full advantage of your internship opportunities. This is probably especially true if attending graduate school is taking your career in a new direction. An internship can help you decided what type of position to pursue and it provides an opportunity to learn more about a specific company.

Students who joined the MTM program in Fall 2003

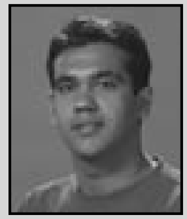
Jianqing Chen
- MTM '05, M.S. in Electrical and Computer Engineering, Engineering Manager, Siemens Hangzhou, a joint venture of Siemens, Singapore.



Kevin Coonan
- MTM '05, B.S. in General Engineering, Performance Management Analyst, Accenture, Chicago, IL.

Yong Hong Ding
- MTM '05, B.S. in Electrical System and Automation, Supplier Quality Assurance (SQA) Engineer, Xerox Asian Commodity Management, China.

Matt Gohr
-MTM '05, B.S. in Electrical Engineering with Computer Science, Information Solutions Consultant, Rockwell Automation, Milwaukee, WI.



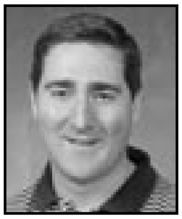
Rajat Moorjani
- MTM '05, B.S. in Civil Engineering, Software Engineer, Infosys Technologies Ltd., India.

Victor Munsen
- MTM '05, B.A. in Biology with a minor in Russian language, Business Developer, Impact Seven, Inc., Madison, WI.

Shradha Pathak
- MTM '05, B.S. in Chemical Engineering, Development and policy research, Pragya, India.

Xiao Dong Yin
- MTM '05, M.S. in Material Science and Engineering, Application Engineer, Dupont Photomask Inc., Singapore.

A Sample of MTM Summer Internships

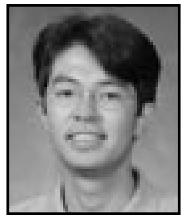


Scott Jiran
Polaris Industries

For almost 50 years, Polaris has designed, manufactured and marketed the most innovative, best performing and highest value motorized products for recreation and utility use. It is the leading manufacturer of cutting-edge snowmobiles, ATVs, personal watercraft and American motorcycles. The company is headquartered in Minneapolis and operates engineering and manufacturing facilities in Roseau, MN; Osceola, WI; and Spirit Lake, IA with a total of 3,000 employees. Polaris products are sold worldwide through a dedicated network of nearly 2,000 dealers in North America and 51 distributors covering 110 countries.

Scott Jiran worked for Polaris last summer helping improve the product development process for the Victory motorcycle division while also filling in as a test engineer. Since 1999, Victory has offered the American cruiser and touring motorcycles that compete primarily with market-dominator, Harley-Davidson. Scott performed a deep-dive into a couple of product attributes to show how a system-engineering approach can improve the final product as delivered to the customer. He also met with the marketing group to discuss product and brand strategy, and learned from the division controller what financial metrics are used to track the growth and health of Polaris' newest venture.

The summer projects Scott completed helped demonstrate to Victory engineers the benefits of a disciplined system-approach to product development. Using this approach, Victory can develop future motorcycles more quickly, more efficiently and with better performance. Scott also had a chance to learn about the motorcycle business as a whole and about the strategies involved with launching a new division into a market that is owned by a single firm.



Yoshiro Fukasaku
Elliott Energy Systems, Inc.

Yoshiro Fukasaku worked for Elliott Energy Systems, Inc. (EESI) that has been developing a micro gas turbine since 1993. Its latest product is a turbo alternator capable of generating 100 kW of electrical power. Yoshiro's objectives for this internship were to gain exposure to a venture firm that incubates the emerging technology, to gainbroad experience at a small company (90 employees), and to enhance his knowledge of the energy industry

During his internship, Yoshiro was responsible for linking EESI with a Japanese equipment supplier to launch a new project for a client in New York. This involved a combination of a micro gas turbine and absorption chiller-heater provided by the supplier. Since EESI, as well as the client, had never worked with the new system, Yoshiro's responsibility was critical for the success of the project. He helped resolve issues such as the determination of specifications of the equipment, assisted with technology transfer from the supplier to the R&D/engineering division, and secured information for the client.

Yoshiro gained two important insights through this internship experience. The first is the necessity of managing uncertainties. The new project provides an opportunity for a significant leap for the venture company but at the same time poses a risk because of the uncertainty associated with technological and organizational challenges. Yoshiro viewed this project as a "living" case study with regard to a new technology venture, concluding that how to manage uncertainties would be a key factor for a successful venture. The second insight is the importance of communication to facilitate international collaboration. By acting as an intermediary in the U.S. firm, Yoshiro realized that the different languages, employment systems, and working styles would produce a communication gap. For example, what is common sense for one side is not necessarily common sense for the other side. Yoshiro had seen the U.S. firms only from a Japanese perspective, but this internship experience helped him understand the U.S. way of thinking.

Erdman Center Hosts China Conference

Above: Urban Wemmerlöv opens the conference.
Right top: Attentive audience.
Right bottom: The panel of experts takes questions from the attendees.

On October 29, 2003, the Erdman Center hosted a conference on "Doing Business in and with China." Over 150 individuals attended, including regional business owners and managers, consultants, university students, and even some high school students. The participants had the opportunity to hear comments by Dr. William Guo, General Manager of Bergstrom-China; Gene Berg, owner of Austin-Westran; Mary Linton, Marketing Manager from Promega; Paul Fichter, owner of Taphandles; Mary Regel of the WI Department and Commerce; and John Eichenseher, Professor of Accounting and International Business at the University of Wisconsin-Madison.

Professor Urban Wemmerlöv's opening remarks began with such ominous statistics as, "In 2000, 37 percent of Chinese university graduates were engineers, compared with 6 percent in the United States," and "there is very little you can't make reliably in China now. Pioneer, for example, recently set up a factory in Guangzhou for its most sophisticated DVD recorder, just a few months after the technology had started production in Japan." These quotes set the stage for a day during which executives, academics and students were able to discuss China's growing economic presence, and the advantages and disadvantages of working in and with China.

The China Conference was a timely forum that brought together diverse concerns and insights about the role that China plays in the global marketplace. Going forward, the Erdman Center will be looking to build on its success with the China Conference and possibly make it a bi-annual venue for discussing current issues related to the globalization of manufacturing.

The 4th International Annual Conference on Quick Response Manufacturing

The Quick Response Manufacturing Center hosted more than 20 experts and speakers from the industry at its annual conference, held on October 14-15, 2003. The welcome address by Frank Rath, Associate Director of the QRM Center, highlighted the pace of growth of QRM ever since its inception in 1993, meeting manufacturing challenges and achieving breakthrough results. The guest speakers from member industries discussed how lead-time reductions has helped them achieve increased operational efficiency, increased market share, and reduced costs. Representatives from Datex-Ohmeda, Rockwell Collins, NuAire Ltd, Stratagem Ltd, S&C Electric Co, and John Deere all advocated the QRM philosophy on the first day of the conference.

The second day began with Bill Ritchie of Textron-David Union Pumps who related his firm's experiences with QRM. Professor Urban Wemmerlöv from the Erdman Center then discussed effective compensation systems for manufacturing employees in cell/team based environments. This was followed by speakers from Varco Systems, John Deere, and Textron touching upon supply chain management, office operations and leadership issues in QRM implementations. At the end of the day, Professor Ella Mae Matsumura of the business school, Jeff Amundson of TREK, Paul Allen of Datex-Ohmeda, and Francisco Tubino of the QRM Center participated in a panel discussion which reviewed accounting and performance measurement to support lead-time reduction. For more information, go to www.qrmcenter.org.

MTM becomes OTM

The Manufacturing & Technology Management (MTM) program will be transformed into the Operations & Technology Management (OTM) program beginning the fall term of 2004. Just as the MTM program did, the OTM program will be concerned with development, implementation and improvement of processes, technologies and management systems. The goal is to teach students to design, make, and deliver goods and services in an efficient and effective manner that brings value to the customer.

The Erdman Center, which also will adopt the OTM name, will support the new program and continue its strong links to several centers and programs on the University of Wisconsin–Madison campus. The Erdman Center will also continue to bring together corporate leaders through its Industrial Advisory Board, and OTM students for networking and mentoring opportunities.

The new OTM curriculum for the MBA degree consists of 58 credits distributed as follows: Required MBA Core (27 cr), Required OTM Core (10 crs), OTM Electives (15 crs) and Free Electives (6 crs). The OTM Electives can be chosen from two of the five areas: Planning, Analysis and Improvement Tools, Product/Technology Management, Manufacturing Processes and Systems, Business/Services Processes and Systems and Information Systems/IT. The free electives can be drawn from business, engineering, science or law in order to suit the student's particular background and career aspirations. For more information, see our website at *www.bus.wisc.edu/erdman.*

The Erdman Center for Manufacturing and Technology Management is the "Home of the MTM Program"

Manufacturing and Technology Management is a cross-functional area of study that is concerned with the development, implementation, and improvement of processes, technologies, and management systems for the purpose of designing, making, and delivering goods and services in an efficient and effective manner that brings value to the customer. This MBA program leverages the students' backgrounds in engineering and science in generating new skills in product/technology development, business and manufacturing process improvements, IS implementation, and the strategic use of technology.

MTM graduates' career goals include leadership positions in operations, supply chain, product and technology management, business development, and consulting. They have been placed in a variety of large and small organizations. Employers include Abbott Labs, Accenture, Celerant, DaimlerChrysler, Deere & Co, Deloitte Consulting, Delphi, Eaton, EPIC Systems, General Motors, Harley-Davidson, i2, Intel, Johnson Controls, JohnsonDiversey, Novartis, Philips Broadband Networks, Promega, Rayovac, Samsung, Schlumberger, Sonoco, Sorrento Lactalis, TRW, ZS Associates, and others.

The MTM Program is administered by the Erdman Center and guided by an Academic Advisory Board comprising faculty from the School of Business and the College of Engineering. Linked to programs is also an Industrial Advisory Board with members drawn from 20+ organizations.

For more information on the MTM Program at the University of Wisconsin-Madison School of Business, please go to *www.bus.wisc.edu/erdman*.

Note: The Erdman Center will change its name — see article on page 11.

The MTM Newsletter

ERDMAN CENTER

The Newsletter is produced by the graduate students in the Manufacturing and Technology Management Program under supervision of Center Director Urban Wemmerlöv. The objective is to inform professionals, faculty, and students of the Erdman Center activities and events in the field of manufacturing and technology management.

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