

## INTEGRATION OF ENTREPRENEURSHIP EDUCATION WITH INCUBATORS AND/OR TECHNOLOGY TRANSFER OFFICES

There are a growing number of entrepreneurship education programs that are developing integration with university technology transfer offices and/or incubators. The Center for Advanced Technology and Innovation (CATI), a collaboration among several Wisconsin universities and organizations, is among the most complex models integrating technology transfer, incubation, and entrepreneurship education from multiple campuses. Other models are simpler. For example, the Berkeley Business Incubator in the Lester Center at the Haas School of Business is a business incubator for start-ups created by current students and recent graduates.

### Overview

- *Economic Development goals are central.* While education is among the goals to be accomplished within these programs, economic development is often a strong priority and can dominate. CATI, for example, was formed explicitly to promote business development, workforce development, and technology innovation in southeast Wisconsin. The main goal of the Center for Commercialization of Advanced Technology (CCAT) (see below, affiliated with San Diego State University) is to move their technologies through the developmental milestones necessary for business success. Similarly, one of the primary goals of Stanford's Biodesign Network (BDN) is to encourage and facilitate invention, patenting and early-stage development of medical devices.
- *Public-private partnership.* Given the economic goals of these programs, partnerships can often encompass both private and public organizations. For example, the Center for Commercialization of Advanced Technology (CCAT) - supported by Congress and funded by the Department of Defense - is a public-private collaborative partnership among academia, industry, and government. Partners include San Diego State University (SDSU) Foundation and its Entrepreneurial Management Center, the University of California, San Diego's (UCSD) Jacobs School and UCSD CONNECT, and ORINCON Technologies, Inc. (a defense and commercial contractor) with support from the Space and Naval Warfare Systems Center in San Diego. The consortium-style CCAT intends to bridge the gap that exists between the generators of technology, the Department of Defense and the commercial marketplace. Stanford's Biodesign Network has a member base of nearly 900 academic and industry participants. A primary goal is to provide networking among individuals who work in the biomedical technology industry.
- *Co- location of Entrepreneurship education and incubation.* Some programs place entrepreneurship education with incubators. For example, Purdue's Center for Entrepreneurship is located in its new Discovery Park. This is a very visible commitment to integrating students with incubator firms. The University of Maryland's Hinman CEO program is particularly unique in that the students reside in the same building as their incubator- like facility.
- *Projects are a critical component.* As is true for entrepreneurship programs in general, project work is critical to these programs as they attempt to move technologies from the universities into start-ups. Student teams are formed around technology concepts, often including students with diverse backgrounds, with the goal of developing business plans.
- *Entrepreneurship education programs are multidisciplinary.* These programs often draw from technical disciplines in addition to Business programs. For example, CATI's program draws from students at Carthage College's ScienceWorks technology entrepreneurship program in which science students – from biology, chemistry, physics, mathematics, and computer science - are also trained in the basics of business and entrepreneurship. The University of Maryland's Hinman CEO program is open to all majors and usually has the following distribution: 1/3 from Engineering, 1/3 from Business, and 1/3 from a range of

liberal arts and science majors. The Hinman program is also residential, and students are placed in rooming arrangements made up of diverse majors.

- *Business School integration.* Entrepreneurship programs integrated with technology transfer and incubation usually involve students from entrepreneurship courses within MBA programs. When other disciplines are also involved, cross-fertilization of knowledge within project teams can occur. Business school faculty members also serve as advisors on projects.
- *Entrepreneurship education content development fostered.* Programs have developed curricular materials arising out of programs involving students in technology transfer and incubation. For example, Purdue's Tti program has supported case and course development by cross-functional and cross-disciplinary faculty teams. Faculty from Strategic Management, Organizational Behavior and Human Resources, Management, and Economics collaborated with Industrial Engineering and Management Science develop original case materials for use in a new cross-functional course in technology management. After sufficient testing in a classroom environment, these cases are intended for publication in book form. Another example is a collaboration between Purdue's Office of Technology Commercialization and Tti leading to a pilot course for the Krannert Engineering/Management Program entitled "Ideas to Innovation: Intellectual Property Basics".
- *Entrepreneurship student involvement creates competitive advantage for incubators.* Students provide a variety of low cost, yet critical, services to incubator firms that allow them to conduct a broader research and development process, broader and more accurate market studies, and preliminary business planning. These services are often considered an inducement for companies to move into incubator facilities.
- *Venture capital alliance development.* Many of the programs have formal or informal ties to the venture capital and angel community. A formalized program is Stanford's BDN Venture Partners program. Its venture capital partners help shape educational program development and participate as speakers and moderators at BDN events. On a case-by-case basis, BDN Venture Partners may also assist with market evaluation and technology assessment as well as providing contacts and resources for development/incubation of new technologies. <http://mdn.stanford.edu/plsql/venture>
- *Foundation funding available.* Foundations will fund these initiatives. The initial success of Purdue's Technology Transfer Initiative was guaranteed by an NSF IGERT grant. This grant will fund 30 Ph.D. students in Engineering and Science for up to two years each. Matching grants from Purdue will fund MBA students to team with the Ph.D. participants. Supporting courses and programs will be developed with the objective of facilitating the commercialization of Ph.D. research and developing researchers and business students with the skills necessary to take ideas from laboratory to market. The San Diego State University (SDSU) Foundation provides support for the Center for Commercialization of Advanced Technology (CCAT). The Foundation functions as a self-contained private corporation, separate from the University, yet integrated into the goals and programs the University and responsible for the accomplishment of certain University objectives. The University of Maryland's program has been supported by Kauffman Foundation, NCIIA, and from faculty research grants.
- *Endowment funding available.* As is true for entrepreneurship programs in general, Entrepreneurship programs integrated with incubation and technology transfer are attractive for endowment funding. Purdue's Innovation Realization Lab (IRL) was endowed by Lilly Endowment, Inc. to support nine IRL Fellows and nine MBA interns from the Krannert School of Management. They will receive support to study issues surrounding the commercialization of the Fellows' research. PhD students enrolled in Purdue's schools of Agriculture, Engineering, or Science are eligible for IRL Fellowships.

Purdue's program has also received private donation from the Alan and Mildred Peterson Charitable Foundation.

## Benchmarks

### Boston University – Medical School

- *The Photonics Center* is an incubator where companies can develop, and commercialize Photonics technologies by accessing equipment, laboratory facilities, and technical expertise, thus leveraging the vast technical assets of the Center and Boston University to augment their company's capabilities. The Center and Beacon Photonics, a holding company that creates vertically focused venture capital development companies (VCDCs) have developed a program that focuses and accelerates the development and commercialization of advanced Photonics technologies and products by bringing together the best ideas, both from within and outside the University, and combining them with the expertise and resources of the University and the business community. Whereas traditional incubators or venture funds provide start-ups solely with space and capital, this unique program affords portfolio companies access to all of the tools necessary to accelerate their time to market. <http://www.thephotonicscenter.com/flash/flash/index.html>

### Columbia University

- *Science and Technology Ventures* (formerly Columbia Innovation Enterprise): The Science and Technology Ventures is the technology transfer function for Columbia University. It seeks to commercialize University-based technology by working with faculty members and industry and venture capital groups to start new businesses based on Columbia's intellectual property. It is also associated with an incubator through its advising of companies on availability of new incubator space in the Audubon Business and Technology Center. One program example appears below; refer to website for others. <http://www.columbia.edu/cu/cie/about.html>
  - *The Center for Advanced Technology (CAT)*. Columbia University's CAT is a joint effort of the Department of Medical Informatics at Columbia Presbyterian Medical Center in conjunction with the Computer Science Department (School of Engineering at Columbia) and the Columbia Genome Center. The CAT is now focused on three major applications: GeneWays, software that extracts information from research literature; GENIES, a natural language processing information extraction program; and, WeaVe, speech recognition technology for the World Wide Web. <http://www.cpmc.columbia.edu/CAT/>.

### Purdue University - Engineering

- *The Technology Transfer Initiative (TTi)*, TTi conducts research on issues industry encounters when trying to license and market new technologies and products. It also will help faculty design courses to teach entrepreneurship. TTi is a multidisciplinary program developed by Purdue's School of Management in partnership with Purdue's schools of Science, Engineering, and Agriculture. TTi's mission is to serve as a catalyst in promoting educational activities and programs on innovation and technology transfer. Four key program elements support TTi's mission: <http://128.210.160.161/wps/portal/pagr/109/pa.109/152>
  - *Research funding* is provided on a competitive basis to faculty interested in the innovation process, factors leading to success or failures of new ventures, issues

surrounding intellectual property rights, and other areas related to the commercialization of research or technically based product ideas

- *Competitive grants* support curriculum development for faculty interested in developing courses in support of TTI's mission.
- The *Innovation Realization Lab* (IRL) matches MBA students from the Krannert School of Management with doctoral students from Purdue's schools of Agriculture, Science, and Engineering in teams to analyze the commercial potential of the doctoral students' research. This NSF funded program spans two years and includes required courses taken by the teams.
- *Business consulting services* are provided to faculty groups working on new technologies and interested in exploring avenues for realizing commercial value from their research. Students and management faculty work with faculty across campus, as well as faculty in the Purdue Research Park, in assessing commercial technology potential.
- Integration with Purdue's Technology transfer office occurs through a management course. A major part of the course involved having teams of students investigate the commercial feasibility of new technology being developed at Purdue. One semester they investigated five specific projects and developed reports in which they appraised these technologies and developed preliminary strategies for commercializing them. Staff from Purdue's Office of Technology Transfer worked with the students to select projects, and in many cases, introduced them to the faculty who had developed the technologies.  
<http://www.mgmt.purdue.edu/centers/tti/>

### **San Diego State University and University of California, San Diego**

- *Center for Commercialization of Advanced Technologies (CCAT)*. The (CCAT) project is a partnership between SDSU, UCSD, ORINCON, the Space and Naval Warfare Systems Center San Diego, and the Department of Defense. It brings agencies together to accelerate the development and application of advanced technologies to solve real-world problems through administering a \$5.2 million DOD sponsored technology commercialization program. The CCAT program is designed to fast-track Department of Defense, industry and academic technologies into commercial and/or defense related markets. New technological ideas are identified for use in addressing an issue of national concern. Experts from the Jacobs School of Engineering at UCSD, defense contractor ORINCON Industries, and the Space and Naval Warfare Systems Center then evaluate a new technology concept to see if it has technical merits. Students and faculty from the EMC and other College of Business Administration departments oversee the market analyses to determine commercial value for the new concepts. Subject technologies may lead to new start-up ventures or be transitioned into existing companies. CCAT offers the following services at no cost for selected technologies:
  - Commercial Feasibility Studies
  - Prototype Development, Test & Evaluation Funding
  - Research & Development Funding
  - Market Analysis Studies
  - Business Plan Development
  - Venture Finance Connectivity
  - DOD Acquisition Assistance
  - <http://www-rohan.sdsu.edu/dept/emc/CCAT/index.htm>
- University of California, San Diego - Jacobs School, (<http://www.soe.ucsd.edu/>) a top-ten engineering school, is the primary link between CCAT and academia, and is a source for

identifying and developing advanced technological concepts. The School solicits and promotes advanced technology R&D projects, performs technical feasibility evaluations, and provides scientific and technological support for CCAT sponsored R&D projects. UCSD Connect (<http://www.connect.org/>) assists in promoting the commercialization of new technologies and facilitates the start-up of new business ventures.

- *UCSD CONNECT*. Founded in 1985 at the urging of San Diego's business community, UCSD CONNECT is widely regarded as the nation's most successful regional program linking high-technology and life science entrepreneurs with the resources they need for success: technology, money, markets, management, partners, and support services. Part of the University of California, San Diego (UCSD), CONNECT has a dual role in accelerating growth: it provides added value and delivers targeted, high-level expertise to San Diego's technology business community by teaming up with the region's most prominent industry-specific organizations and individuals, and by partnering with world-class UCSD resources, such as the School of Medicine, Jacobs School of Engineering, San Diego Super Computer Center, and Scripps and Salk Institutes.

CONNECT's services are tailored to meet the varying needs of San Diego entrepreneurs at all stages of their business life cycles and growth. Since its inception, CONNECT has assisted more than 800 technology companies. Its programs serve as a catalyst for the development and exchange of ideas, a forum to explore new business avenues and partnerships, and an opportunity to network with peers.

## Stanford University

- *The Biodesign Network (BDN)*. BDN is a continuation and expansion of the *Medical Device Network (MDN)*, which was founded in 1997. It explicitly focuses on technology transfer, providing education, advocacy and mentoring to students and faculty who wish to bring their innovations forward through the university to be developed into commercialized healthcare products. BDN also provides connections to the professional communities that specialize in biomedical technology, such as investors (angel, venture capital and institutional), medical technology equipment manufacturers, and attorneys who specialize in intellectual property and new venture formation. With a member base of nearly 900 academic and industry participants, the Biodesign Network website provides a mechanism for networking among individuals who work in the biomedical technology industry, particularly medical devices, diagnostics, tissue engineering and related areas. The goals of the network are:
  - To encourage and facilitate invention, patenting and early-stage development of medical devices
  - To develop Stanford as an effective regional resource for research and education in the area of biomedical technology design and development.

MDN sponsors a number of conferences for the device community and helps organize a series of courses in medical device design and development. In the area of technology innovation MDN has developed a successful "Invention Challenge" methodology at Stanford and conducts a mentorship program for young inventors. MDN works with the Office of Technology Licensing to develop effective evaluation and licensing strategies and has established important connections with the local financial and biomedical technology industries. <http://mdn.stanford.edu/plsql/about>

- The Stanford University Program in Biodesign <http://biodesign.stanford.edu> is a unique academic program focused on the invention and implementation of new health

technologies through interdisciplinary research and education at the emerging frontiers of engineering and the biomedical sciences. The program is organized administratively into four major units, (technology transfer/network, research, education and ethics & policy), each with a director and leadership group.

### **Tulsa University**

- *Tulsa University Innovation Institute (TUI2) Certificate Program in Innovation and Product Development.* The TU Innovation Institute (TUI2) provides a unique interdisciplinary forum where **engineering, business, arts and sciences**, and **law** students come together to study and develop comprehensive plans for marketable technology-based products. Students also collaborate with the Oklahoma Technology Commercialization Center (OTCC) to analyze actual business plans submitted by aspiring entrepreneurs. <http://www.utulsa.edu/fyi/index.pl?group=2&bullet=2>

### **University of California – Berkeley**

- *Berkeley Business Incubator.* In 1997, supporters of the Lester Center established a business incubator for start-ups created by current Haas School students and recent graduates. Located near the business school, the incubator is designed to provide office space and advanced telecommunications capabilities to promising new ventures that have progressed beyond initial planning. Proximity to the school also allows enhanced access to the Lester Center's resources, including the networks of venture capitalists, attorneys, accountants, and consultants that are so important to the Bay Area's entrepreneurial process. The incubator is funded with donations from advisers and friends of the Lester Center. <http://www.haas.berkeley.edu/advantage/entrep.htm>

### **University of Maryland**

- *Hinman Campus Entrepreneurship Opportunities (CEOs) Program.* The nation's first living-learning entrepreneurship initiative, brings students together from diverse majors to learn how to start their own businesses. A specialized, high-technology "e-Dorm," seminars and workshops from venture capitalists and successful businesspersons, industry-student mentoring, and unique entrepreneurship education courses give students a stimulating and supportive environment in which to dream and realize their ideas. An incubator like atmosphere is created by facilities for meetings, office equipment, computers, staff support, and a small seed fund. The program culminates in a business plan for each new student venture and assistance to obtain financing. Offered to undergraduate students who have demonstrated interest and potential strength in entrepreneurial ventures. Students from **all majors** can apply, and all aspects of diversity are sought. The Program promotes the development of student teams that have the goal of pursuing an entrepreneurial venture. Each student team is assisted in the development of a business idea from conception, through design and ultimately to the formation of a company. This process takes place over a period of up to three years while the students are undergraduates, culminating with the students being prepared to pursue a successful entrepreneurial venture upon graduation. <http://www.hinmanceos.umd.edu/>
- Students have access to the resources of the Clark School's Engineering Research Center (ERC), which offers an internationally recognized incubator for technology based start ups (TAP), as well as funding opportunities for joint research and development of market-driven products and processes (MIPS). <http://www.erc.umd.edu/TAP/>

### **University of Pennsylvania**

- *Wharton Venture Initiation Program (VIP). "From Concept to Capital".* The VIP is a business incubator for companies that are owned and operated by students and recent graduates of the University of Pennsylvania. The aim is to foster a series of Penn student businesses that are honed for success: better developed, more polished and professionally nurtured. In other words, 'Venture Ready'. Managed and operated by the *Wharton Small Business Development Center (WSBDC)*, the VIP provides client companies with the entrepreneurial management education, support, and physical facilities that are essential for starting a new business. VIP services are given without cost or loss of equity to the participating student teams.  
<http://www.wharton.upenn.edu/whartonnow/entrepreneurship.html>

### University of South Florida

- The Center for Entrepreneurship is a multi-disciplinary, campus-wide center focusing on entrepreneurial education, training and research. The Center operates a full service technology incubator the **USF Technology Accelerator** that serves to accelerate the growth of technology-based businesses. The Accelerator operates as a "living, learning laboratory" in which USF faculty and community entrepreneur leaders grow new ventures leveraging the research discoveries at USF. USF's students work directly with both faculty and entrepreneurs to give a deeper understanding of how to create, grow and successfully launch new technology ventures. <http://www.entrepreneurship.usf.edu/>

### University of Texas at Austin

- *Austin Technology Incubator (ATI).* ATI supports promising high growth companies in a variety of technology-based industries, through a targeted services package which includes strategic advice, access to financing, marketing & P.R. support, benefits program, mentoring, and turn-key infrastructure. ATI is supported by the University of Texas, the City of Austin, and the Austin community, and works with a variety of investors, a "know-how network" of professional service providers, outside industry experts, and others, for the benefit of its member companies. <http://www.ic2-ati.org/index.asp>

### Wake Forest University

- *Medical Technology Transfer.* This program includes summer entrepreneurial internships (11 in last three years), Management Consulting Practicum projects (8 in last three years) and special initiatives such as FastTrac Tech (a 12-week program for individuals who want to launch new technology-based ventures). The Angell Center's relationship with the WFU Office of Technology Asset Management is excellent, and they continue to intensify their contributions to the commercialization of their inventions. <http://www.mba.wfu.edu/ace/>
- *Babcock Demon Incubator (BDI).* Operating under the Angell Center for Entrepreneurship, the incubator's mission is to foster entrepreneurial education at Wake Forest and an entrepreneurial spirit in the Triad by providing personalized services and relationships to growth-oriented, early stage ventures. The incubator offers office space and Internet access for growing businesses. It will house three to five start-up businesses, with tenants admitted on a rolling basis throughout the year. Each business that enters the incubator will have approximately 12 months to grow and find a permanent location. The goal for the incubator is to launch businesses that have the potential to create significant economic impact in the Triad through jobs and business investment. Among the businesses to be housed in the incubator will be winners of the Triad Entrepreneurial Initiative's annual business plan competition. The BDI is developing

into a premier university-based incubator with its own unique business model. In addition to playing an instrumental role in helping launch new ventures, the BDI serves as a living laboratory for students and faculty. <http://www.mba.wfu.edu/incubator/>.

### **Wisconsin (Partnership of multiple organizations, including universities)**

- *The Center for Advanced Technology and Innovation (CATI)*. CATI, a separate 501(c)(3) corporation, was formed to promote business development, workforce development and technology innovation in southeast Wisconsin. Located in Racine County, Wisconsin, CATI represents a partnership among local and regional educational institutions, regional business development organizations, local and regional governments, and private industry. Partners include: Carthage College, Gateway Technical College, the University of Wisconsin-Parkside, the Racine and Burlington school districts, and regional economic development organizations (Racine County Economic Development Corporation, RAMAC, Workforce Development Center). It's this strategic partnership that allows CATI to bring all the necessary skills, capabilities and resources to develop new products, services, and businesses, while simultaneously creating the future technology workforce. It has three main components:
  - *Technology Incubation*. CATI operates an incubation facility as well as offers virtual incubation services where new and developing firms can develop and market new technology products and services.
  - *Technology Transfer*. In the traditional sense, technology transfer has involved the commercialization of university-related research. CATI has a unique partnership with the **University of Wisconsin-Parkside**, **Carthage College** and the **TechStar** Initiative to create technology transfer opportunities in Racine County. CATI also views technology transfer as the commercialization of underutilized intellectual property from existing companies, as well as the development of new product/service development through the application of upstream technologies.
  - *Cati Education*. The CATI educational program is integrated with local colleges, universities and school districts to provide project-based learning opportunities to students from high schools, colleges, entrepreneurs and a wide range of audiences, including under- and unemployed individuals.
- <http://www.thecati.com/>