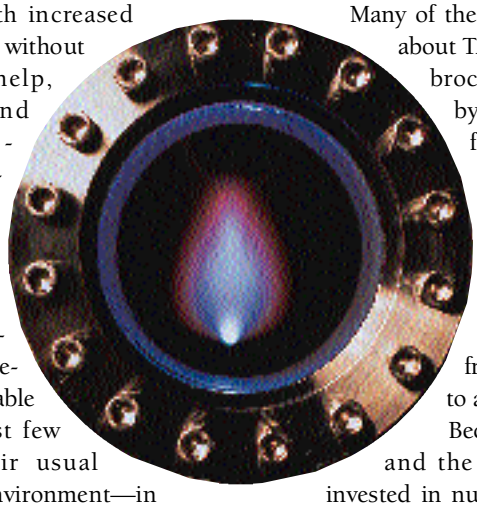
by David F. Barbe, Herbert Rabin, and Edward M. Sybert

Incubating Technology-Oriented Start-Ups

Backed by the broad expertise that resides in research universities, university-industry partnerships can yield benefits to both. They help companies become more competitive, which in today's global economy requires continual improvement of manufacturing processes, a steady flow of new technologies, and innovative products. At the same time, a university benefits from such agreements by conducting company-sponsored research and by the exposure of its faculty and students to company problems and decisions.

In 1984, the University of Maryland, College Park (henceforth, the University), established the Engineering Research Center (ERC) to promote interaction in engineering and science between the University and the business and industrial community. The ERC currently conducts four major programs, one of which, the Technical Advancement Program (TAP), serves as an on-campus "incubator" that provides business and technical support to start-up companies. TAP has proved to be a model incubator program, one that other universities, both U.S. and foreign, are showing considerable interest in following.

Although large companies often have the resources to deal with increased competition without outside help, small- and medium-sized companies face a more difficult situation. Start-up companies are especially vulnerable in their first few years. Their usual operating environment—in the homes of the founders or in low-cost commercial space—is relatively isolated from individuals and companies pursuing similar goals and generally devoid of any support structure. Commercially run incubators can provide benefits such as low-cost space and shared office equipment, but not a depth of supportive expertise.



Major research university campuses, however—with their engineering, science, and business departments; libraries, laboratories, and computer resources; and faculties, staffs, and students—offer nearly ideal environments for technology-oriented companies to marshal their strengths and grow. Thus, the concept of a university incubator has emerged, which provides campus space for start-up companies to conduct business in an environment rich in engineering, scientific, and business infrastructure and expertise.

The Maryland model

Companies with many different focuses have participated in TAP. Roughly half of the 13 companies currently in the incubator are developing biotechnology products. Other types of companies have also participated, including those engaged in information, electronics, instrumentation, automotive, materials, aircraft, and space technologies.

Many of these companies learned about TAP from news articles, brochures, presentations by ERC staff, referrals from economic-development organizations, and the Internet. The most consistent means by far, however, is by word of mouth, passing from one entrepreneur to another.

Because of limited space and the considerable effort invested in nurturing companies in the incubator, ERC rigorously assesses the potential of each candidate company. After an initial informal screening to eliminate obviously unsuitable applicants, two formal reviews are conducted. The first usually involves a panel of University faculty and R&D experts from industry and/or government whose expertise matches the technology that the company plans to develop. At the review, the company makes a presentation of its technical plan, and the panel provides feedback and evaluation.

If the technical panel finds that the company stands a good chance to succeed technologically, the company moves on to a business review. The review panel typically consists of faculty from the College of Business and Management, investment bankers, and other individuals from the local business community who examine the company's business plan and offer their assessment.

Tapping into Profitability

Neocera, Inc., has its corporate sights aimed high: to make the microelectronics and sensor-based instrumentation start-up a $100 million company by 2006. It's a tall ambition for a company that now employs only 20 people. But then, when Neocera (Beltsville, MD) emerged in 1995 from its incubator experience, it was already profitable, a rare feat among graduating companies.

The company was founded in 1989 by its chairman, T. "Venky" Venkatesan, now a professor of electrical engineering and physics at the University of Maryland. Neocera's entry into TAP in 1991 provided it invaluable resources. "What you get as a young start-up company is access to millions of dollars of University equipment, laboratories, workshops, and other things that are just tremendous," says president Bruce Hegstad. "The second thing they give you is access to world-class professors and students. The access to technology, the access to people, and the access to assets is worth its weight in gold."

Initially, Neocera focused on developing high-T_c superconducting films using—and improving upon—pulsed-laser deposition (PLD), a technology Venkatesan helped pioneer at Bell Laboratories. Neocera sold its first thin films and first PLD hardware in 1992 and turned a small profit that year—black ink that has increased every year since.

Neocera quickly became a world leader in making PLD equipment, and its development of unique materials and devices for many high-tech uses, including advanced radar, telecommunications, and microelectronics, spurred further growth. The privately held company makes a practice of not releasing financial data, but according to Hegstad, revenues last year were "in the moderate seven figures."

Since leaving TAP for its own new quarters, Neocera has awarded the University about $700,000 in research grants, Hegstad says, and the University has exercised its stock-purchase option and now owns about 4% of the company.

Results from both panels then go to ERC management for the final decision on admission. During both reviews, the company and faculty identify areas of mutual interest, with the anticipation of significant interaction. Often, the reviews provide a company with important contacts that can assist it in the future. Some companies have been admitted to the incubator after they revise their plans following advice provided by the panels.

Once a company is accepted, it signs a contract with the University that lays out the costs to the company; the support the University will provide and its right to review company progress; the company's length of stay in the incubator; and other legal issues. The nominal term of occupancy is two years, with option agreements for succeeding years. A company pays a monthly fee that depends on the amount and type of space it occupies (i.e., office, wet laboratory), and the University has the right to acquire 1% ownership of the company for each year it remains in TAP.

Typically, incubator companies are developing prototype products. The University makes every effort to provide them assistance and advice from its nationally ranked A. James Clark School of Engineering and the College of Business and Management, including the Dingman Center for Entrepreneurship. Another campus, the University of Maryland, Baltimore, provides legal assistance to incubator companies through its Law and Entrepreneurship program.

The TAP director and others in ERC serve as matchmakers for incubator companies seeking connections to campus researchers, students, laboratories, and other facilities. Company employees have access to faculty laboratories, support facilities, and the use of equipment and instruments. Research collaborations often develop with faculty, and it is quite common for incubator companies to hire students who become full-time employees upon graduation. The average incubator stay lasts three to four years.

A record of success

The odds nationally of a new company still existing after five years are only about 20%. Although this statistic applies to all new companies, it indicates the vulnerabilities that technology-oriented start-ups face. Of the companies admitted to the University incubator prior to 1993, approximately three-quarters survived at least five years after their formation. This statistic indicates a dramatic improvement in the odds of success, but it is not possible to separate out the contribution of the rigorous admission process from the factors associated with the supportive incubator environment.

Since the University began its program in 1985, 270 companies have applied to the program, 106 have gone through the review process, 45 have been admitted, and 13 are currently in the incubator. Of the companies that have graduated, three are publicly traded and three are anticipating making their first public stock offerings shortly. Participating incubator companies have attracted more than $175 million through both equity and R&D funding. More than 430 workers, mostly professionals, are employed by companies that are TAP graduates or still in the incubator.

Operating an incubator for technology-oriented companies over the past 13 years has provided valuable insights. One of the most recurring observations is that most people who form start-up companies are well prepared to handle the technology aspects of their enterprise, but not the related business issues. The companies that do best begin with a strong business orientation, usually provided by a business-knowledgeable member of the initial team.

Another lesson learned is the need for space flexibility. A typical start-up begins with a few people, and companies that succeed grow to 20 to 40 employees within a few years. An incubator must be structured, both physically and managerially, to accommodate this growth. Another factor is the need for university incubator staff to maintain objectivity, encouraging all companies equally and working for their success. Finally, helping companies locate sources of investment is an important function of incubator management.

Soaring on Unorthodox Wings

When Freewing Aerial Robotics Corp. (College Station, TX) received a contract in February to deliver a second unmanned aerial vehicle to NASA, it was another affirmation of the growing interest in the tiny company's radical Tilt-Body aircraft.

Neither a fixed-wing craft nor a helicopter—nor a hybrid of the two—the craft's wing rests on bearings, so it is completely free to rotate in pitch. The result is a craft capable of magnificent contortions that takes off much like a helicopter, flies at airplane speeds, and neutralizes turbulence for a stable ride, yet has only three moving parts. Its potential uses range from military and drug surveillance to power-line inspection and environmental monitoring.

Founded in 1987 by Huge Schmittle, an aerospace marketer, and Odile Legeay, experienced in international finance, the company was in residence at the University of Maryland incubator from 1989 until late 1996. "They gave us two things we didn't have before: credibility and access to research tools, most principally the wind tunnel," says Schmittle. "Both of those were absolutely key to getting Freewing off the ground."

Schmittle and Legeay formed their company to improve on an old concept called the rotatable wing, first flown in 1942. In 1992, the company finally developed its patented Tilt-Body design, which won several awards for innovation, including a 1996 R&D Award for Excellence from *Research & Development* magazine.

Over the years, Freewing has formed strategic alliances with several larger firms. Recently, it built an airframe production line in Texas and completed work on the craft's avionics and other control and data systems. Freewing has now sold one craft to Matra Défense, S.A., a large French defense contractor, and leased two others to NASA for use in its Earth-oriented research programs.

Revenues last year totaled about $200,000. The company employs 5 people full-time, but because of its strategic alliances, "there are probably 20 people in effect working full-time on Freewing's behalf," Schmittle says.

BIOGRAPHY

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