

## UNIVERSITY - INDUSTRY ENGINEERING PARTNERSHIPS

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### Introduction

The Advisory Council for the College of Engineering and Applied Sciences at Arizona State University has the motto: "A Partnership for Engineering Excellence." This motto is in fact a truism. If engineering schools are to reach excellence, they must form good partnerships with industry. The partnership is mutually beneficial. Industry is interested in hiring qualified new engineers. They also are interested in life-long learning opportunities for their employees to get them abreast of the rapidly changing world of technology and to prompt the creative thinking necessary for a company to remain competitive. On the other hand, Arizona State University (ASU) is seeking good students and jobs for its graduates. In addition the university recognizes that hands-on experience for engineering students enriches the classroom, enhances employability, and provides financial support.

ASU is located in a valley with over one million people and many high tech industries. These industries recruit heavily from ASU. The College of Engineering and Applied Sciences (CEAS) at ASU has formed many university-industry partnerships, which can serve as models for other educational units and industries. These partnerships include advisory councils, student internships and co-ops, faculty associates from industry, industrial site student classes and projects, and donations for scholarships, equipment, and programs.

### Advisory Councils

Advisory Councils play an important role with most organizations. The council gives additional insights, direction, and support to a university, college, department, program, or organization. For example, an Advisory Council for Engineering composed of representatives from industry and the universities have worked together for many years to the advantage of CEAS. Several years ago engineers from the council were successful in lobbying efforts with the state legislature in funding an Engineering Excellence Program. Now in its fifteenth year, this program was responsible for the funding and the establishment of six Centers of Excellence. During this time industrial relationships have expanded,



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the college has enjoyed growing national recognition, and recently a seventh center, Aerospace Research, was established.

Recently a group of eleven industry people (plus one university representative) held a strategic planning retreat. The purpose of the meeting was to obtain general guidance and specific recommendations from industry on 8 - 12 topics for Industry/Faculty Task Teams. The meeting process was professionally facilitated for brainstorming and prioritization of recommendations. The result was ten proposed topics for further Task Team study. These task teams will incorporate additional industry personnel.

One of the proposed topics is "Technical Focus." The task team is to focus on selective areas of excellence and to identify growing technologies with valley relevance. This team will also review the current Engineering Centers and study emerging engineering practices and design processes. A "Faculty Excellence" task team will develop a faculty performance management system. They will also consider how to attract and to retain the best faculty and to identify work-arounds for compensation inflexibility. The "Flexible Education" group will pioneer "Knowledge Delivery on Demand." They will study remote learning, lifelong learning, and industry responsiveness. A "Program Content" team will review the overall curriculum for both undergraduate and graduate students. An "Industry Partnering" team will develop new partnering concepts, create a more permeable boundary with industry, identify and mitigate barriers, and address intellectual property rights. Other task teams are: Benchmarking, Innovative Teaching Methods, Recruiting Excellence, College Organization, and Marketing/Public Relations.

Besides giving program advice and direction, the industry representatives on Advisory Councils are often able to give personnel and financial support to programs. If they are not able to do this directly, they can usually direct the university to the proper place to obtain support. Personnel support can take several forms. An engineer may be appointed as a faculty adjunct to teach a special course for the college. Industry may be willing to loan an engineer for a semester or a year to the college. Engineers from industry may be speakers at engineering college events, student meetings, or an engineering class.

#### Corporate Leaders Program

People who understand technology are needed in our increasingly high tech societies to play a greater role in decision making in corporations and communities across the continent. The Corporate Leaders Program at ASU is looking for leaders of the future. Through a highly competitive selection process, winners are offered the chance to participate in a unique leadership development program that will change their lives. All applicants must have an accredited undergraduate engineering or computer science degree, or one that is strongly technology-related.<sup>1</sup>



Five types of opportunities are available to engineers and computer scientists in the ASU Corporate Leaders Program. These programs are Industrial Fellows, Business Fellows, Entrepreneurial Fellows, International Management of Technology Fellows and Corporate Fellows. Regardless of designation, all Fellow participate in the ASU Corporate Leaders Program as follows: by pursuing a full-time master's degree at ASU, by working 20 hours per week for their corporate sponsor (with a guaranteed full- time summer job), and by participating actively in the leadership development component of the program.<sup>1</sup>

Applicants who wish to stay with their current employer, who is willing to sponsor the applicant, are eligible for the Corporate Fellows Program. If the applicant is willing to leave their current employer, they may apply for positions in the other programs. In addition to the graduate studies and related work experience, the fellows participate in community service projects. Many students have worked with United Way agencies in using technology to help these local, non-profit organizations solve problems. Often the assistance is a computer solution. In addition to the technical skills needed, people skills are used in presentations to the appropriate boards.<sup>2</sup>

A concern that inspired the Corporate Leaders Program is that many engineering students opt for good-paying jobs over graduate school after completing their bachelor programs. Often these students come back to get a master's degree at night. This scenario does not usually produced excellence. Obviously this program is a win-win situation for industry and academia. This spring there were 440 applicants for about 10 fellowships. The university is obtaining a quality student and industry is gaining an outstanding leader as well as technically competent employee.<sup>3</sup>

### Graduate Career Change Internships

Since 1982 a successful Graduate Career Change Program (GCCP) has been conducted in the Department of Industrial and Management Systems Engineering at ASU. This program recruits mostly women who are unemployed or underemployed in a technical area. The program participant must have a bachelor's degree and have completed several deficiency courses including: three semesters of Calculus, linear algebra, a programming language such as C, two semesters of calculus-based probability and statistics, operations research and simulation. The Master's program is then a 30 semester hours program for the Master of Science in Engineering degree. The student may write a thesis for 6 semester hours or take written comprehensives.

The GCCP program features peer group support, professional development seminars, socials, and optional industrial internships. Speakers



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for the seminars are often from industry, in particular, often graduates of the career change program. The industrial internships are half-time during the academic year and may be full-time during the summers. The GCCP student usually carries nine semester hours of classes while working half-time. The agencies are usually quite flexible to allow for major studying during exam times.

The internship gives financial support, possibly a practical topic for a thesis, and certainly real world experience to take to the classroom. From an industry point of view, the agency obtains a mature, capable, highly motivated employee with a minimum of recruiting costs, no moving costs, and a minimum investment. While there is no obligation to hire, most of these career change students have families in the valley and therefore would be very stable employees. The program does give the company the opportunity to review an individual on a temporary basis and then to hire permanently only if it is to the company's advantage to do so.

To date, over forty of the career change women and men have interned in industry and government. These interns have received top reviews from their management and most received a permanent position from the intern company. The intern is not an employee of the company, so would not affect head count nor contribute to internal paperwork and overhead. Since the donation should be income tax deductible, and no fringe benefits need be paid, with a most reasonable investment, the industrial plant should receive a competent worker and prospective employee.

#### Elementary School Partnership Program

A partnership between the professional chapter of SHPE and the ASU student chapter of SHPE brings engineering to the elementary or junior high classroom. Once a week a volunteer SHPE engineer from industry, along with a volunteer SHPE engineering student, visit an elementary school for one hour. During this time they give a science experiment, demonstrate physics or engineering applications, or perhaps conduct a mathematical game. The schools selected are high ratio minority schools. During the 1993-94 academic year, 120 students were visited in 5 separate classrooms in a K-6 school. This inner city school was 93% minority, with most of the students being Hispanic. In a rural K-8 school with 90% minority students (mostly Hispanic), 40 students were visited in an 8th grade class during the '93-'94 year. The engineer and the engineering student promote and enrich the science program at the school, as well as serve as role models.

Along the same line, an Entrepreneurial Fellow, from the Corporate Leaders Program, recruited fellow engineering students to assist her in an elementary school program. The Fellow coordinated "World in Motion," a program that teaches physics concept to elementary schoolchildren. This program could easily be enhanced by using engineers to work along side the students. Again the engineer and engineering student serve as excellent role models for the young students.

### Women Helping Women Scholarships

Several years ago a group of Phoenix women professionals decided to pool donations and to give scholarship money annually to a woman engineering student who had in turn helped other women. It is interesting to note that none of the benefactors are themselves an engineer. However they recognize the importance of having more women in technical decision making jobs. The scholarship is based on the contributions of the applicant to helping other women on either a paid or a volunteer basis, her career goals, her academic and professional background, courses and grades earned to date in this career change, and financial need. This past year the professional women gave \$2,700, which was distributed into a \$1,000 scholarship, a \$700 scholarship, and two \$500 scholarships.

### General Internship, Co-op, and Summer Hires

An on-going partnership between universities and industry is that of co-ops, internships, and summer hires for engineering students. Usually co-ops are of a semester or semester plus summer duration for a full-time appointment in an industry. The students usually are registered for one or more credit hours during this time to fulfill continuous enrollment requirements, and to allow for insurance coverage. The credit hours may or may not apply toward graduation. Some companies hire directly (with some advertisement help at the university) and others prefer to run it through the Dean's Office in CEAS. In this latter way, overhead and headcount are avoided.

A local technology industry, located in the Valley of the Sun, has summer interns from all over the United State. The manager of these interns recently expressed some frustration over the activities available for these interns. Their largest need seems to be the lack of opportunity for sports events and for community involvement. The Program Director for MEP and for summer camps to be held this summer for minority students and the manager are collaborating to have the interns participate with the summer camps in the sporting and social events. At the same time the interns would be serving as excellent role models for the camp populations.

### Partnership in Curriculum Development

This fall a new elective course will be offered as the result of an industry/university partnership between ASU and Intel. CEAS, ASU, was recently awarded a \$1.3M grant under the Technology Reinvestment Project for "A Holistic Approach for Preparing Students to Learn and Lead in a New Manufacturing Paradigm." As a part of this program the course "Introduction to Manufacturing" is being developed. The course idea was conceived during a brainstorming session of university and industry representatives. The course will be held on-site at a local manufacturer. Vans will take students to Intel twice a week for seven hours of on-site work per week.

The class leaders will select 10 actual manufacturing projects which need to be solved within Intel. The projects will then be analyzed to define which probable activities will be needed to solve each problem. Based on the analysis, six of the ten projects will be selected for the class. Most of the projects will be on continuous improvement, but some will require process redesign. A Project Report will be required at the end of the semester. This report will include the solution to the problem and recommendations for implementation of the solution.

The pilot class, which will be limited to 24 students, will be composed of mechanical, electrical, and industrial engineering majors. The students will be divided into six teams of four each. Each team will be assigned an Intel Mentor. The Mentor is to step back, let the students take the lead on the project, but to intervene if the team gets far off the appropriate path. Most of the teaching, which will be done by an ASU engineering professor and representatives from Intel University, will be team teaching, collaborative style. The course will feature brainstorming, problem solving, cost estimation, product and process design, teaming, statistical process control, material handling systems, and some design of experiments.

The purpose of the class is to get undergraduate engineering students interested in manufacturing early, so they will be interested in selecting advanced manufacturing technology courses for their program of study. For this reason, a goal for the course is to keep it fun and interesting. In the long run, it is hoped that this exposure to manufacturing will lead more students into choosing a career in manufacturing.

### References

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3. Schneider, Paul, "Building engineers into leaders," Arizona Business Gazette, May 12, 1994, p.2.



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