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Successful University-Industry Partnerships

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Abstract

Higher Education will need to partner more closely with the business and industrial community to prepare their graduates for the workplace of the future. The participation of universities in consortia will continue to increase. Universities will need to work closely with other institutions in order to attract resources needed to serve the many different types of students requiring education in the next century. For example, as they do now, adults who change jobs will seek training in new fields; numbers of traditional students living on campus will decrease as distance learning and home computers forge increasingly significant roles in higher education; and as the cost of higher education spirals upward, more and more students will go to school part-time because they need to work. Educating these students for space-related careers will become more important as the commercialization of space continues to grow and develop. A part of their education should be hands-on, real-world experiences with the space industry. Internships for summers and/or for academic years can be brokered through the already strong network of institutions associated with the national Space Grant program and the NASA Field Centers. A few Space Grant consortia have a record of success in this area. After a brief summary of the national Space Grant program, this paper will outline the characteristics of successful university - industry partnerships in the aerospace arena.

The National Space Grant College and Fellowship Program: Overview

The U.S. Congress mandated the National Space Grant College and Fellowship Program with the National Space Grant Act of 1988. Congress placed the responsibility for management and oversight of the program with the National Aeronautics and Space Administration (NASA). The NASA Office of Human Resources and Education, Education Division implemented the program in 1989 with 21 university-based consortia. Since then, the program has grown to a national network of 52 university-based consortia, one in all 50 states, the District of Columbia, and the Commonwealth of Puerto Rico. Each of these Space Grant consortia operates under an independent charter to serve the needs of their state constituencies. However, each consortium is charged by NASA to align their programs with the national Space Grant program goals and objectives. The national objectives are as follows:

- Establish and maintain a national network of universities with interests and capabilities in aeronautics, space and related fields;
- Encourage cooperative programs among universities, aerospace industry, and Federal, state and local governments;
- Encourage interdisciplinary training, research and public service programs related to aerospace;
- Recruit and train U.S. citizens, especially women, underrepresented minorities, and persons with disabilities, for careers in aerospace science and technology; and,
- Promote a strong science, mathematics, and technology education base from elementary through secondary levels.
Space Grant contributes to the U.S. science enterprise by funding research, education, and public service projects through a national network of 52 university-based Space Grant consortia. The network’s 700 plus affiliates include academic institutions, business and industry, state and local government agencies, other federal agencies, and nonprofit organizations. During the past several years, space grant consortia have filed numerous patents, patent applications and invention disclosures and competed successfully for $150 million of research and development (R&D) funding.

**Space Grant Universities and Industry**

Five different Space Grant Consortia were examined for their relationships among academic and industrial partners. The Alabama, Florida, Kansas, Massachusetts, and New Jersey Space Grant Consortia each demonstrate successful long-term partnerships between their academic institutions and industry. A set of common elements appears to be necessary for success. These include:

- Leadership from within the consortium willing to seek out industry partners,
- Effective two-way communication between the consortium and industry,
- Incentives for industry to partner with the academic institutions and vice versa,
- Common interest in a research project,
- Student involvement in the research, and
- A stable funding base from which to broker the initial partnership.

**Leadership**

Leadership from within the consortium most often comes from the Space Grant director. Faculty in a science or engineering department at the consortium lead institution usually holds the director position. For Alabama, it is the University of Alabama at Huntsville; for Florida, it is the University of Florida at Gainesville; for Kansas it is the University of Kansas; for Massachusetts, the lead institution is MIT; and for New Jersey, it is the Stevens Institute of Technology.

**Effective Communication**

Effective communication between the consortium and industry relies heavily on the leadership of the consortium. The consortium initiated the industry partnerships that are currently in place. The effort for the partnership did not come from industry initially. The consortium must facilitate continued communication on a regular basis—for example, monthly or quarterly at minimum.

**Incentives to Partner**

When an industry enters a partnership with an academic consortium, it gains access to relationships with the university that can help the industry accomplish risky or otherwise non-priority projects much faster than they could accomplish them without the academic involvement. Industry also benefits from the intellectual resources of the university community and often has access to equipment owned by the state or the university. Finally, industry has first access to experienced students with the potential to become future employees.

For the academic participants, both students and faculty gain real-world experience with the commercial partners. This is valuable for students seeking employment after graduation—it helps
them to present a more competitive resume. Faculty benefit by keeping abreast of the latest industry trends and needs. With industry partnerships, the university produces a more direct service to the local business community. When political funding decisions for higher education are made in the state or at the local level, this direct service bodes well for the university.

**Common Interest**

A common or shared interest among the consortium institutions and the industry partners varies in each of the five examples. For instance, in Kansas, the partnerships center on aviation and aircraft manufacture. In Alabama, materials research is more often the theme. In Massachusetts, the main objective is to create learning opportunities for student researchers in aerospace fields—to allow the students to obtain real world experience and become more competitive in the job market. While New Jersey also sponsors a successful student internship program with industry, the consortium funds several aerospace research projects per year as well. Florida’s space grant consortium supports aerospace research projects that have the potential for commercial technology transfer. In each of the five states, the particular research interests depend on the individual institutions and expertise involved.

**Student Involvement**

Student involvement in research, at both undergraduate and graduate levels, occurs in each of the five examples. The space grant consortium usually funds student stipends, though stipends may also come from industry. In any case, a professional scientist or engineer (either from industry or the university) mentors the student researchers. This student-mentor model is being tried successfully in a few other space grant consortia besides the five that were examined for this study. Colorado, California, and Texas Space Grant institutions are each implementing student-mentor research programs with industry or federal partners.

**Stable Funding Base**

The National Space Grant College and Fellowship Program, as funded by Congress and administered by NASA, provides the stable funding base that each of the five consortia needed to implement an industry partners program. Alabama, Florida, and Massachusetts each receive an annual federal Space Grant that approximates $475,000. These states use a portion of that funding to ensure a successful industry partnership. The level of funding varies by state from $10,000 to $50,000 per project. Kansas and New Jersey each receives an annual federal Space Grant that approximates $250,000. Again, the amount spent by each state varies, with the minimum and maximum slightly lower than the three larger grant states. Though Kansas and New Jersey are not funded as well as Alabama, Florida, and Massachusetts, they have developed excellent industry partnerships—an accomplishment that reflects directly on the leadership from the University of Kansas and in New Jersey, the Stevens Institute of Technology.

Each year the national Space Grant budget is the subject of controversy within NASA and for the past three years, Congress has allotted more funds for the program than NASA has requested. That Congress has done this for three years speaks to the national effort exerted annually by the 52 members National Council of Space Grant Directors. Without a stable funding base from which to fund the industry partners program, the five states could not offer the incentives they do for industry participation.

The potential economic return on the investment of a stable funding base may well exceed expectations. Any one of the research projects could turn out a form of commercial technology that
results in great revenue to the individuals, the industry, the university, the state, and the nation. It is a small initial investment that Congress recognizes could bring great benefits.

**A Sample Plan for Academic Consortia Seeking Industry Partners**

South Carolina’s Space Grant consortium, funded annually at approximately $250,000, would like to establish partnerships with state and regional industry. The five-step plan that emerged for South Carolina could be tailored to fit other university consortia. Each major step of the plan is supported with sample actions that the consortium may want to consider.

1. **Communicate with state business and industry the desire to partner for mutual benefit.**

   Sample actions:
   a. Host an Academic-Industry symposium or open house type affair at a central location.
   b. Invite a famous or very successful individual who can interest area Industry in partnerships with NASA through consortium universities.
   c. Visit state business and industry that have space applications or the potential for space applications and inform them of space grant consortium and the NASA Tech transfer mission.
   d. Communicate relevant NASA programs to all area industry and to all state and local research universities.

2. **Develop a funding base to seed the Industry Partners Program**

   Sample Actions:
   a. Approach the state legislature with the idea and show them how it will increase employment and the tax base in the state.
   b. Approach area business and industry to show them how partnership will allow them to accomplish risky R&D with very little investment.
   c. Write proposals to other agencies that support this type of economic development.
   d. Write proposals to state and private organizations that support this type of development.

3. **Begin a pilot program with available funds as soon as possible.**

   Sample actions:
   a. Set aside $25,000 of first available funds to enable at least two partnerships.
   b. Hold statewide competition for junior faculty to propose for the Industry Partners seed grants. Faculty will have to find their industry backing in order to win the proposal—1:1 match. E.g. If academe puts up $7,500; the industry partner puts up $7,500 so the faculty gets funded at $15,000 for the research project.
   c. Encourage students to participate in a Summer Internship Program that can be implemented with area industry as soon as possible. Internships can be co-funded by the consortium, the participating industry, and the participating university or college.

4. **Begin to educate universities, faculty, and students about NASA’s efforts to partner with academe to commercialize its already developed technology.**

   Sample actions:
   a. Communicate space grant consortium potential with all NASA Field Center Tech transfer programs.
b. Communicate space grant consortium potential with the NASA tech transfer Center in Wheeling, WV.

c. Communicate space grant consortium potential with the NASA regional tech transfer centers.

d. Communicate space grant consortium with the state of SC and regional tech transfer organizations and economic development organizations.

e. Partner with the SC Community College System to deliver education and training in space related technology to state-based business and industry.

1. Broker student internships with area industry.

Sample actions:

- Find Business and Industry partners from the surrounding areas—begin with state’s research and development authority, research council, technology council, economic development council, Business and Community Clubs, etc.
- Offer a significant incentive for students to participate as interns—e.g. $4,000 stipend minimum for 8-10 weeks of summer.
- Offer release time to faculty to mentor the student interns.

Conclusion

To better prepare science and engineering students for the future workforce, Space Grant consortia and other science-oriented academic consortia may want to consider finding industry partners among their state, local, and regional communities. From the examples studied, the rationale for partnerships rests on mutual interest and mutual benefit. The following lists illustrate the concept of mutual benefit.

Reason’s Universities might be attracted to Industry Partners

- Can tap industry for political, economic, human and infrastructure resources.
- Experience for faculty and students solving real industry problems.
- Summer or academic internships for students.
- Can tap industry for professionals to serve as student mentors.
- Technology Transfer and subsequent royalties that may accrue to the university.

Reason’s Industry might be attracted to Space Grant type consortium

- Collaborative nature of the consortium—industry can tap multiple academic institutions with one-stop shopping.
- Positive political influence—Congress has been very supportive of the national space grant program and its judicious use of limited resources.
- Can accomplish high-risk R&D for minimal cost.
- Consortium provides to industry a single, accessible source of resident expertise.
• Consortium becomes a source of potential employees with real-world problem solving experience.

Recommendations

The industry partnership programs described are not without weaknesses. Problems must be recognized and overcome by the consortium. Strong, informed leadership from the consortium is essential. A list of more commonly reported problems includes:

• Communication barriers due to cultural differences—profit making vs. altruism.

• Different 'reasons for being', different bottom line—must recognize and accommodate each participant’s motive.

• Must insure intellectual property rights for the university participants.

• Students and faculty can be ‘used’ as source of cheap labor—consortium must guard against and ensure they are compensated and satisfied with their participation.

• Industry secrets can be leaked to competitors—industry must set up safeguards.

Summary of Suggestions for Success

• Establish effective communication

• Find areas of common interest

• Define common problems

• Initiate solutions that benefit both partners

• Use a Student/Mentor approach

Note to readers: For those interested in learning more about the National Space Grant Program, its sister program, the NASA Experimental Program to Stimulate Competitive Research (EPSCoR), NASA industry programs, or the individual space grant programs mentioned in this paper, please consult the following web sites:

Space Grant:  http://www.hq.nasa.gov/spacegrant

NASA EPSCoR:  http://www.hq.nasa.gov/epscor

NASA:  http://www.nasa.gov

NASA’s Small Business Program:  http://www.sbir.nasa.gov/

Individual Space Grant consortia can be linked to from maps and links on the main Space Grant page above.