AC 2008-1729: IMPACT: A MULTIDISCIPLINARY APPROACH FOR CREATING HIGH-TECH STARTUPS

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IMPaCT: A Multidisciplinary Approach for Creating High-Tech Startups

Abstract
There is a recognized need for creating new innovative high-tech ventures in order for the United States to remain competitive in a global market. This paper will explain how a series of NSF grants, industry partnerships, and collaborative courses have established a multidisciplinary pipeline for identifying and creating high-tech startups capable of competing in the new economy. Engineering faculty and students work closely with their business school counterparts to not only design and test new products, but to also create new innovative ventures.

Projects in the IMPaCT (Innovation through Multidisciplinary Projects and Collaborative Teams) program typically begin by funneling promising faculty research through an Innovative Venture Research (IVR) class. The Innovative Venture Research class is populated with engineering and business students (along with any other student on campus with an entrepreneurial spirit) who spend ten weeks identifying potential applications and markets for the raw research. The next phase of the project is to create multidisciplinary Venture Enhancement Teams (VETs). The VETs use parallel business and engineering courses to simultaneously create a marketable prototype and a sound business plan. The next phase of the program is to demonstrate the new product and business plan to industry professionals, venture capitalist, and other interested parties via a business plan competition and senior design conference.

Products that are not ready for a commercial market, but have shown potential for commercialization can be assigned to another Venture Enhancement Team the following year. Finally, products that are ready for commercialization are awarded space in our business incubator. This collaborative process has already proven effective with the licensing of one project from the 2006-07 academic year. Additionally, industrial and governmental funding of five projects from the 2007-08 year indicates a promising future for the program. This paper will demonstrate an effective method for collaboration between faculty, students, and industry in the creation of high-tech startups.

Introduction and Background
Louisiana Tech University is located in a largely rural area with little high-tech industry. In order for this region in particular and the country in general to be competitive in the coming years, new and innovative industries must be developed. The IMPaCT program helps to create new high-tech entrepreneurial efforts in the region by providing an environment for the development of new products based around faculty research and student ideas. One of the major goals of the IMPaCT program is to create an entrepreneurial environment for students and faculty that promotes the development of high-tech startup companies in the region.

The IMPaCT program essentially began during the Fall 2004 and subsequently received two years of NSF funding (NSF-0536482). IMPaCT began as an adaptation of Purdue’s EPICS (Engineering Projects in Community Service) program. EPICS was initiated in the fall of 1995 with NSF funding and has been hugely successful. The IMPaCT program provides opportunities for students from all over campus to work together to solve problems. Students can elect to enroll in IMPaCT from several different perspectives. A student can participate in IMPaCT through an engineering capstone design course, or through one of several other courses.
connected to the program. An IMPaCT project lasts for at least one academic year, some projects may span multiple years, although it is not necessary for a student receiving elective credit to enroll for the entire year. Over the course of the year, student teams take a project from idea to prototype to business plan. IMPaCT teams consist of engineers, business students and other majors. The key points of IMPaCT are shown in Figure 1. The structure of the IMPaCT program has been described in more detail in previous ASEE conference proceedings.²

<table>
<thead>
<tr>
<th>Multidisciplinary</th>
<th>Students, faculty and other partners working collaboratively</th>
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</thead>
<tbody>
<tr>
<td>Integration</td>
<td>• Vertical from Freshmen to Seniors</td>
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<td></td>
<td>• Horizontal across college boundaries</td>
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<tr>
<td>Academic Credit</td>
<td>• Senior engineers receive capston design credit</td>
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<td></td>
<td>• Incorporated into core business courses</td>
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<td></td>
<td>• Elective credit options</td>
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<tr>
<td>Project Advisors</td>
<td>• Faculty research advisors</td>
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<td></td>
<td>• Real world industry partners serving as reality checks</td>
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<tr>
<td>Lecture Series</td>
<td>• Weekly lectures introduce topics to student teams (market size estimation, conceptual designs, prototyping)</td>
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<tr>
<td>Skill Modules</td>
<td>• On-demand delivery of specialized content (rapid prototyping, soldering, business plan development)</td>
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<tr>
<td>Product Development</td>
<td>• Prototype products are developed using an approach similar to the IDEO design philosophy</td>
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<tr>
<td>Business Plan</td>
<td>• Teams prepares a business plan for their products</td>
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<tr>
<td></td>
<td>• Business plan competition with cash prizes</td>
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**Figure 1.** Key Points of the IMPaCT Model.

Several recent developments at Louisiana Tech University laid the groundwork for IMPaCT and other collaborative efforts. In 1996, the science and engineering departments of Louisiana Tech were merged to form a new College of Engineering and Science (COES), and an innovative administration structure was employed to facilitate strong interdisciplinary collaborations for both research and education.³⁴ This collaborative structure has allowed for the development of innovative interdisciplinary undergraduate programs such as our Integrated Curricula and multidisciplinary programs such as our Center for Entrepreneurship and Information Technology (CEnIT).

Beginning with the creation of the Center for Entrepreneurship and Information Technology, Louisiana Tech has become a leader in the state in IP development and tech transfer. The Office
of Intellectual Property and Commercialization has negotiated 6 new licenses and options in fiscal year 2006, received 31 Reports of Invention (ROIs), and filed 17 patent applications. During that same time period 4 patents have been issued and our faculty have received 6 SBIR awards and established 5 new technology start-ups. The innovation productivity at Louisiana Tech University (as measured by ROIs per $10 million of external research funding) is 19. According to the Association of University Technology Managers the national average is 4. These accomplishments are the results of collaboration between the College of Business and the College of Engineering and Science that creates an environment that encourages entrepreneurial activity. The IMPaCT program is one part of this collaboration.

**Integrating IMPaCT into Louisiana Tech University’s Strategic Plan**
Creativity is a process which can result in the development of novel and useful ideas or processes by an individual or a group. Creativity is associated with a variety of positive workplace outcomes including innovation and productivity and is often considered necessary for innovation to occur. Creative activity occurs at the interface of disciplines working on problems that are cutting edge from the viewpoints of all team members involved. Innovation is deploying inventions in the market place. As such, innovation is “commercialized invention”. Thus, innovation is enhanced with an entrepreneurial team. Entrepreneurs set themselves apart from small business owners by the creativity they exhibit in deploying innovative new products and business models. Drucker describes the linkage this way: “Entrepreneurs innovate. Innovation is the specific instrument of entrepreneurship. It is the act that endows resources with a new capacity to create wealth. Innovation, indeed, creates a resource.” The multidisciplinary nature of the IMPaCT program is an excellent environment for truly creative commercialization solutions to be conceived and the entrepreneurship principles introduced to the students in the course helps to empower the student teams’ skills in innovation.

A significant part of the strategic plan of Louisiana Tech University is to build the economic development resources of the region by accelerating the commercialization of its inventions represented by its Intellectual Property (IP). The primary purpose is to implement a novel program for transformation of recommendations about University IP from our Innovative Venture Research process into concrete products or venture opportunities that fuel economic development in this region and across the country. Our recent experience has demonstrated that using multidisciplinary teams of business and engineering students and faculty to refine product applications and plans for commercialization will significantly reduce the risk to the ultimate licensee. This makes the IP transfer opportunity more attractive and successful commercialization more likely. Five strategies for accelerating the commercialization of university IP have been identified and are shown below.

**Strategies for accelerating the commercialization of university IP**
- creating an accelerated and effective process for developing working product prototypes recommended in the University’s IVR process
- involving University faculty, undergraduate, and graduate students directly in this process in one-year development projects
- partnering and networking with investors and regional Venture Capital groups so the process results in prototypes and business plans which reduce the risk of commercialization
- facilitating the inter-institutional collaboration of researchers and IP experts when acquisition of non-University IP is desirable to reduce overall commercialization risk
- enhancing the interdisciplinary experiential education in prototype development and business planning for students by commissioning prototypes and planning projects
Based on these strategies our objective has been to form Venture Enhancement Teams (VETs), which operate within our IMPaCT Design course. This course consists of engineering capstone seniors and business students interested in market driven product design. The arrangement of VETs within the IMPaCT program and how they work in concert with the University’s Innovative Venture Research process and Triage Team is illustrated in Figure 2 below.

**Figure 2.** Diagram of the Multidisciplinary Approach for Creating High-Tech Startups.

Florida *et al.* believe that the university comprises a powerful *creative hub* in regional development; however, alone, the university is insufficient for successful regional economic development. These authors conclude that, to harness its capability to generate innovation and prosperity, the university must be integrated into the region’s creative ecosystem. The Innovative Venture Research program at Louisiana Tech, augmented by the IMPaCT course’s use of external mentors and consultants will help bring about this integration. One process for commercializing faculty research begins with presentations by faculty inventors to a group of
community leaders, economic development professionals, and local entrepreneurs who ultimately serve as mentors to the Venture Enhancement Teams, we call this group the Triage Team. The purpose of these presentations is to give the Triage Team an overview of the raw faculty research so that the team can make an informed recommendation on which projects should be directed to the Innovative Venture Research phase of the program. The following is a description of the key multidisciplinary teams in the IMPaCT program.

**Triage Team** – The Triage Team is the mechanism for regular and effective involvement of our expert partners; and in addition, the partners are a ready investor network, enhanced by the University Research Foundation and the local community through our Technology Opportunity Forums. The Triage Team’s primary purpose remains to provide technical and business guidance to ensure that each project receives the level of attention and support consistent with its potential for success.

**Innovative Venture Research (IVR)** – IVR is a ten week multidisciplinary course which students take during the spring term (IVR is also offered during the summer on occasion). Once the research has been filtered to an IVR course, student teams identify and describe the specifications of a product that has the potential to be commercially successful. The IVR teams identify a need that the faculty research can fill, determine the market size for this need, and recommend products for further development. Innovative Venture Research teams often recommend the preparation of business and marketing plans or Small Business Innovation Research (SBIR) grant proposals to demonstrate how the licensee can raise risk capital. These recommendations from the IVR teams are forwarded to an Augmented Triage Team.

**Augmented Triage Team** – This Triage Team will continue to assess Innovative Venture Research Team reports and recommend actions for the University regarding technology transfer. It consists of project partners who are familiar with venture capital, technology commercialization and IP transfer. Currently the Triage team consists of 5 members, but will be enlarged to 10 to accommodate its additional responsibilities for selection of projects whose risk profile will be enhanced through prototype development, additional practical business planning and IP collaboration. A decision is made by CEnIT staff members and faculty inventors to forward the most promising recommendations to the Venture Enhancement Teams for further development as part of the IMPaCT courses.

**Venture Enhancement Teams (VETs)** – VETs are formed from undergraduate students enrolled in the 3-quarter sequence of the IMPaCT product design course and undergraduate business students. These teams may also include MBA and graduate engineering students. Each Venture Enhancement Team chooses a technology previously researched in the Innovative Venture Research course or otherwise recommended for commercialization. The teams are supplied with the resources needed to create the prototype and are supervised by IMPaCT course instructors and research faculty inventors as well as CEnIT staff and community mentors. The teams also prepare a business plan, marketing plan, or SBIR proposal, as appropriate for follow-on funding.

**Implementation Highlights**

Private parties have expressed interest in purchasing options to license the rights to prototypes, and a private “Prototype Fund” has been created by the University Research Foundation to match the University’s commitment of resources. Having the prototype available for demonstration is
an essential element that facilitates commercialization. This was proven during a recent licensing deal with a California company for the rights to a variable focal length microlens technology developed at Louisiana Tech. During the Innovative Venture Research team research they contacted the company; and that contact, with special funding from CEnIT, led to the creation of a prototype that demonstrated the concept and solidified the private sector interest. Further highlights of the IMPaCT program as given below.

2004-06 – By Fall 2006, there had been fourteen IMPaCT teams (three pilot teams and eleven full-scale teams). These teams have ranged in size from three to six members and have worked on a variety of projects. Some examples of the projects to date include a home-based biodiesel production facility, real-time water chemistry analysis, a technique for improving the coal to gasoline process, and a portable device for the relief of migraine headaches. These projects represent faculty research, industry sponsorship, and student generated ideas.

2006-07 – During this academic year, a team developed a nanocatalyst based on faculty research that significantly enhances the conversion of biomass (e.g. wood waste) into liquid petroleum. The team’s product has since been licensed to a regional company and has received over $2 million in venture funding. Not only are Louisiana Tech and the faculty member benefiting from this development, but the IMPaCT students responsible for the product development are also seeing financial rewards for their hard work.

2007-08 – Four initial Venture Enhancement Team projects were selected for the Fall 2007 quarter. These projects received seed funding from CEnIT and have demonstrated strong commercialization potential. These Reports of Invention were previously researched in the IVR course. The Innovative Venture Research teams in each case recommended the creation of specific working prototypes and attractive business models around which detailed business plans can be prepared. The faculty inventions have also undergone peer review and received funding by a number of agencies including NSF, NIH, and DoD. Faculty inventors were invited to submit their intellectual property for further development under this program.

In summary, the IMPaCT program will continue to provide opportunities for students from all majors to work together to solve problems. Students participate in IMPaCT through an engineering capstone design course, or through one of several other courses connected to the program. Over the course of the year, student teams take a project from idea to prototype to business plan. Moreover, the synergy of the Innovative Venture Research course, Venture Enhancement Teams, and IMPaCT course structure has accelerated the commercialization of university intellectual property and economic development in our region.

Bibliography


