2006-76: DEVELOPING ENGINEERS WITH AN ENTREPRENEURIAL SPIRIT

Gerald Nelson, Mississippi State University

Gerald Nelson, an industrial engineering graduate (1974) with an MBA (1985) from Mississippi State University, began his career with a co-op experience at Rockwell International. Nelson worked five semesters with Rockwell before joining them full time after graduation as a Project Engineer and Program Manager.

Nelsons career includes former positions as Plant Manager, Trinity Industries; President and Chief Operating Officer of the Wear Resistance Group of Thermadyne Industries, Inc.; Executive Vice President of Operations, Viasystems Group, Inc.; and Chief Operating Officer of Deka Medical, Inc.

Nelson was selected as Director of the Engineering Entrepreneurship program through professional association with Dr. Wayne Bennett, Dean of the College of Engineering. The program is funded through an endowment given by MSU Alumnus and Entrepreneur Jack Hatcher of Pinehurst, NC.

Developing Engineers with an Entrepreneurial Spirit

Introduction

Since the passage of the Bayh Dole Act in 1980, there has been an increase in activities in technology transfer nationwide according to the Council on Governmental Relations.[1] The significant changes in the handling of Intellectual Property has enabled exclusive licensing by the universities enhancing the ability of university personnel to participate in the commercialization of technology. Over 300 public universities in the United State have since created some form of Entrepreneurship program. In 2000, under the leadership of Dean A. Wayne Bennett, Mississippi State University's Bagley College of Engineering recognized the need to promote such a program.

The Jack Hatcher Engineering Entrepreneurship Certificate Program at Mississippi State University was initiated on February 7, 2001, with a primary investment of $1.25 million. Since its inception as the first endowed (entrepreneurship) program on the land-grant institution's campus, the original endowment has grown to $1.5 million. Jack Hatcher, a native of Mississippi, is a 1949 civil engineering graduate from Mississippi State University who also holds a master's degree from Georgia Tech. Hatcher founded and sold the second largest metal building company in the United States and served as CEO of Robertson –Ceco. He has remained involved in this program since the beginning as both a mentor and advisor. In March 2001, Gerald Nelson was appointed director of the entrepreneurship program, and in May 2002, he was appointed to the Hatcher Chair for Engineering Entrepreneurship. Gerald Nelson and Robert Taylor co-authored the "Mississippi State University Engineering Entrepreneurship Program," which was presented by Dr. Taylor at the 2003 ASEE conference. This paper will focus briefly on an overview of the program to date, but will primarily address the long-term goals, the culture adjustment that is ongoing, and the strengths and weaknesses of such an endeavor.

The Vision

The vision statement for this program was a combination of the shared visions of Mr. Hatcher, Dean Wayne Bennett and the Director:

Jack Hatcher

Vision of the Jack Hatcher Engineering Entrepreneurship Program

- The engineering student who is in business can receive the education and experience to pursue a technical/business career.
- The entrepreneurship program provides a forum for learning and experiencing business firsthand from professionals.
- The certificate process builds teamwork and communication skills in interdisciplinary project teams.
- The student who desires to launch a business is provided with foundational knowledge, experience, and mentoring.

- The student who decides to pursue an engineering or management career goes into the work place with a working knowledge of business and as a more valuable employee
- Mississippi and the surrounding states enjoy a higher level of economic development.

As noted in the above listed points, there is no expectation of an immediate flow of successful enterprises on the campus. Although, this would not necessarily be an undesirable outcome, the goal of the program is more in the realm of building a firm foundation. That being said, start-ups provide the laboratory for a variety of learning experiences, which is difficult to simulate in the classroom. We will discuss the aspect of nurturing start-ups later in the body of this paper.

The Marketing Plan for the Certificate Program to the Students

The Certificate Program was marketed initially by writing and printing a brochure that succinctly described the requirements and benefits of the program. The program was then presented through a variety of means. The program was primarily marketed by "word of mouth". Brief presentations were given to students enrolled in required engineering classes, such as Engineering Economy, a course required by multiple disciplines. Students who have completed the program have been the most effective advocates for the program. This "word of mouth" marketing has resulted in 60 students in pursuit of the certificate and another 20 who are participating in some part of the program. The director's work has been centered on signing up and guiding the students successfully through the program. The students then recommend the program to others. There have been 27 certificate graduates to date.

The Components of The MSU Engineering Entrepreneurship Program

The Coursework

As a joint effort with the school of business, a considerable portion of the program's coursework is taught through the College of Business and Industry (COBI). The department of management in COBI teaches the final course, Entrepreneurship. The focus of the course is the writing of a business plan. The engineering students have usually identified their entrepreneurial "company experience" project at this point and are able to utilize this course as a basis for writing their project/ business plan. The director serves as a mentor as well as a resource, providing names of other mentors for both technical and business oversight. Other required courses include basic accounting, marketing, engineering economy and economics.

The Projects and Business Plan Competition

From the beginning, the goal has been to provide ideas and business mentors to the student teams that form around a project. The initial project was with the Viking Range Corporation and involved both a Mechanical and an Electrical Engineering Team that coordinated the design of a new high-end dishwasher. The Viking engineering team mentored the project and traveled to MSU for the presentation of the final project. There have since been a variety of projects (about 20) that have ranged from medical devices to electronically controlled duck decoys. In some cases, the ideas are offered by sponsoring companies and at other times the student team

originates them. To date, we have had six of our eight engineering disciplines represented in the competitions.

Viking Range Corporation is a manufacturer of high-end kitchen appliances located in Greenwood, Miss. Viking Range Corporation proposed the first certificate program project. They pioneered the commercial-grade cooking range for the home kitchen. Viking has recently acquired the Amana line of appliances and is expanding its product base. Viking challenged the teams to develop new ways to clean dishes. In response to the challenge a team formed around the Viking dishwasher idea. The team was made up of a three-member electrical team composed of: Michael Nestler, Naquisha Causey, and Rockell Ingram, and a six-member mechanical team including: Brian Snowden, Jason Lea, Justin Crapps, Justin Goldman, Matthew LeCren, and Matthew Jennings. The electrical team focused on the controls, electronics, and user interface, while the mechanical team focused on the hydro-mechanical processes.

In addition to the ideas that come from companies, student concepts are also encouraged. Jon Cavin and Paul McCarley, both mechanical engineering students, along with Susan Robertson from the College of Business formed a team to develop a concept for a variable backpressure automobile exhaust system. The system automatically tunes the exhaust backpressure for maximum performance throughout the full range of engine speeds. This team won first place in the Fall 2002 business plan competition.

Our 2003 Business Plan Competition winner was Paula Jean Runge (BSME 2004). Paula Jean developed a mechanical device that weaves hay into rope for use in the baling process. Paula Jean's presentation was enhanced due to the excellent communication skills she has acquired through the Bulldog Toastmasters Club
sponsored by the Bagley College.

The 2004 winner was Dustin Bailey with AquaFeatures, Inc. Dustin had already started this business in the Jackson area. Dustin also was a very good communicator and a member of the Toastmasters Club as well. He is a senior majoring in computer engineering. Hunter Jones placed second with an innovative software company proposal.

Tommy Thompson won the Business Plan Competition in 2005, with an innovative Scuba Mask concept, which allowed the diver to read the critical pressure and depth from inside the mask. He recently graduated from the mechanical engineering program and is currently employed by ExxonMobil in Houston. Before graduating from the university, Tommy established an endowed scholarship by pledging $25,000.

The Seminar Series

Interested students on an ad hoc basis can attend the weekly Seminar Series or students can enroll in the course for one hour of class credit. Current enrollment is about 55 students. Weekly attendance ranges between 80-100 students. This is the broadest base of the Jack Hatcher Entrepreneurship Program. The objectives of the Seminar Series are:

- Through examples of case studies, give the students insight into the process of recognizing opportunity.
- Provide basic knowledge of the underlying business skills required to start and run a business
- And, through the life stories of successful entrepreneurs, build students' self confidence to take advantage of opportunities

The speaker list includes: Barrie McArthur, Founder of Diversified Technology, Inc.; Rodger Johnson, President of Knology, Inc.; Les Lampton, founder of Ergon, Inc.; Bill Yates, founder of Yates Construction; and Virginia Carron, an Atlanta patent attorney. This is just a small sampling of the more than sixty guest speakers to date.

The director plans and coordinates the speaker list with input from faculty members, specifically faculty from the engineering disciplines that have been most engaged in the program. Electrical and Computer engineering is one of these.

The Entrepreneurship Club

The Entrepreneurship Club serves as an important catalyst in regards to student involvement and interest in the program. Now with 30 student members, the club hosts speakers as well as other entrepreneurs and guests while they are visiting campus.
They also assist in managing other entrepreneurial activities on campus. The director serves as the faculty advisor.

Certificates Awarded to date

Twenty-seven graduates have completed the program with another ten scheduled to complete the program in May 2006. There are currently fifty students seeking Entrepreneurship Certificate at this time.

The Initiative for Business and Technology (IBAT)

During the process of starting and nurturing the Jack Hatcher Entrepreneurship Program, the director and an alumnus from the College of Business and Industry were commissioned to conduct a study and interview process to assess and propose improvements to the university's commercialization process. The team was enlarged to include faculty from the College of

Business and Industry and the director of the Intellectual Property and Technology Licensing office, as well as others involved in University Outreach and also, Venture Capital.

The reason for inclusion of this event into this paper in two fold: 1) the IBAT process was a campus wide process that revealed a number of strengths and weaknesses in the existing culture and inherently the culture under which the Jack Hatcher program operates; 2) If we are to successfully educate students on the process of entrepreneurial ventures then we must in some measure produce opportunities for learning in these types of environments. If the University was located in a metropolitan area this might be served by existing ventures but in a small city of 20,000 (Starkville, Miss.), the opportunities are limited and thus the need is greater to produce opportunities for hands-on learning. A partial answer to this issue was to come in the form of the Thad Cochran Endowment for Entrepreneurship.

The Thad Cochran Endowment for Entrepreneurship

Dr. Charles Lee, President of Mississippi State University, along with Dennis Prescott, Vice President of External Affairs, recognized the need for funding of small ventures on the college campus. In 2005 an endowment was established in honor of Senator Thad Cochran for his years of service to the State of Mississippi. This endowment will fund start-ups involving students and faculty under a program structured to provide mentoring and funding, as well as guidance in reaching other funding sources. The goal is to fund five to ten start-ups per year.

In 2006 the endowment will be operational, and become fully funded in 2008 at $3.5 million. Although not a complete answer to funding needs, the process and mechanism that this endowment will bring is even more far reaching. “Success begets success” and the model built herein will serve to change the University culture over time, with hopes to breed an entrepreneurial mindset or at the very least accelerate the process already underway.

As a natural progression of the Hatcher program, the program director has agreed to coordinate this newly created endowment as well. In order for the student experience to include more hands-on experience in start-ups, the endowment will assist and funnel proposals campus wide to this source of initial seed funding and expose them to further funding sources as well, exposing students to the experience of actually starting a business on a small scale. The start-up can initially be accomplished under an umbrella mentor company and later, if successful, spin out into an incubator or become a stand-alone company. The director is working in conjunction with the Business College and the Office of Research to develop the process. The higher level of start-ups on campus will greatly increase the interaction of both engineering and business students to collaborate in these new ventures.

Weaknesses of the Current Program

Funding seems to be a consistent area of weakness in both the commercialization and entrepreneurial process. The funding necessary to take “research” to “technology”, that is, to produce a commercially viable product, is lacking in the university environment. Small Business Innovation Research and Small Business Technology Transfer funding is available but inadequate. The other funding weakness exists in the funding of patent prosecution and

maintenance. For example, many viable ideas are shelved due to the lack of funding in this area or it is left to others to pursue without protection for the inventor or the university. These issues must be addressed in the long term. A possible solution would be to secure an endowment form our successful alumni base to partially fund the "gap" between research and a commercially viable product. Partnering with industry in specific areas of interest might also be a solution.

Another area of weakness to commercialization in the University environment is the lack of emphasis placed on the commercial usefulness of the technology being researched. Many times our research is aimed at solving a problem that only exists on a small scale. This is not always undesirable because funding drives research and research has to aim for funded programs. In time, however, it would benefit us to steer the "ship" of research toward more commercially viable projects. Market or potential market should influence a portion of our research initiatives, up to and including the inclusion of commercial partners and business plans early in the planning stage.

Strengths of the Current Program

The existence and support of our entrepreneurial alumni base is a tremendous strength to us here at Mississippi State University. The Jack Hatcher program has served to enhance the development aspect of college relations with a number of alumni. The relationship formed by the simple act of involving them in the lecture series has led to an increase in giving and in better relations for the future. Over sixty successful entrepreneurial alumni have addressed the seminar series thus far. As we develop further in the area of entrepreneurial activities, these same alumni will be invaluable in mentoring start-up companies in fields related to their own.

According to Blake Hudson, Director of Development for the Bagley College of Engineering, "The certificate program has been well received by our alumni. The seminar series has provided a venue to involve alumni who have participated in entrepreneurial ventures or have been intrapreneurial in their corporate careers. As a result, some of these alumni have made substantial private gifts to the Bagley College of Engineering." [2]

As the University matures in the entrepreneurial process, MSU's alumni base has begun to reveal itself as a tremendous resource. MFJ Enterprises a Starkville-based company, founded by Martin Jue, hires co-op students, mentors senior design projects, and has recently offered to house an electronics start-up company as an incubator. As the program continues to grow, there are many more men and women who will become involved in the entrepreneurial process.

Next Steps

What then is the next level? How can Mississippi State University and the Bagley College of Engineering best leverage their considerable resources in the area of entrepreneurial education? We began with a vision of the program that is complete in itself. Our next level is thus not to be additive to the vision but to provide a more mature program. The second point of the vision statement is "The entrepreneurship program provides a forum for learning and experiencing

business firsthand from professionals." This is the next level for us here at Mississippi State University.

We have, to some degree, changed the culture in the last four years. Students have heard of the program and enrollment continues to grow. We are exposing them to successful entrepreneurs in the seminar series, and we are providing them with a basic working knowledge of business. One of our measurement tools has been "a list of business terminology to know and understand" garnered from the visiting executives in the early semesters and from the College of Business and Industry faculty as useful and pertinent to today's technology-based business environment. We have tested incoming students in the program and then seniors completing the program for working knowledge of the terms. The increase is from an average of 20 % to an average of 88% in recent semesters. We lack, however, in providing sufficient opportunities for involvement in business creation and operation.

The next level is to provide a mechanism for the student (and faculty) entrepreneur to experience first-hand (even if it is as an employee or an intern) a role in a new business creation on or near the campus environment. The mechanism includes such currently unavailable resources as:

- A culture of learning wherein multiple courses in every engineering student's experience delve into entrepreneurial questions such as market size, risk, and return
- A recognizable mechanism that inventors and entrepreneurs will recognize as the place to take the idea for needed help
- Business Planning assistance for student and faculty inventors
- A network of active alumni entrepreneurs and faculty assisting the process
- A portion of faculty with an entrepreneurial experience and mindset
- Multi-disciplinary projects and work space
- Pre-seed and seed capital availability
- Micro finance capital such as Tufts University's new Omidyar endowment[3]
- A return of capital to the university to fund future activities

A current model of the next level, in part, is developing on campus this year. A team of doctoral students along with a Professor in the Forest Products Department has been researching a method of termite control utilizing electronic technology. The University has been granted a patent and is pursuing others in this area. The team also includes an electrical engineering professor who designed the device. A business plan has been written for this proposal. Under the Thad Cochran Endowment for Entrepreneurship, a mentoring team has been established for a start-up company. Exclusive licensing has been negotiated and the launch will take place this year. The product, by eliminating the need for termiticide, is environmentally favorable as well. As award recipients of the Thad Cochran Endowment, the company will receive assistance in a variety of the areas listed above as the next level. We look forward to a program that, although founded in engineering, will drive a culture of entrepreneurial activity and learning campus wide.

Summary

The process of developing a culture of entrepreneurship on a college campus takes time and planning. The adequate funding must include not only a vehicle for learning, such as the certificate program but also a long-term perspective and the buy in to the process from the

administration. The “ship” of research must be directed over time to commercially viable research, at least in part, and the funding for a viable product after completion of the basic invention or research is complete must be provided.

The nurture of start-ups on the campus will provide the “laboratory” for entrepreneurial students. At least a portion of the new faculty could perhaps be some whose experience included start up experience.

Funding for pre-seed, seed, angel and venture capital must in time be made available if a program is to flourish.

Finally, the university must become user friendly to the entrepreneurial student and faculty. This should include all of the above as well as incubator or similar programs and access to resources that can assist the inventor and the researcher in plan writing as well as execution.

1 http://www.ucop.edu/ott/bayh.html

2 Blake Hudson, Director of Development, Bagley College of Engineering, in conversation with the author 12/6/05.

3 David Kirkpatrick, Fortune magazine, November28, 2005, p.49.