

Getting Engineers to Think and Act like Entrepreneurs

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Rose-Hulman Institute of Technology

Rose-Hulman Institute of Technology is pioneering the education of undergraduate entrepreneurial engineers. *Engenius Solutions* is a program funded through a grant from the Lilly Foundation. The project, at Rose-Hulman, is offering capital and other resources to help undergraduate engineers understand what it takes to recognize opportunities and turn them into entrepreneurial ventures. Students, faculty, and staff are encouraged to submit ideas to Engenius Solutions for evaluation and review. Following an in-depth qualification procedure, those deemed to have potential are then given project resources including student project teams, prototyping support, work space, Intellectual Property support, and project management to help develop their idea. Engenius Solutions also provides financial, marketing, and business insight to assist their clients (**students, faculty, staff**) in taking ideas from concept to market. Future plans include accepting clients from outside the Rose-Hulman community. The program is driven by a core management team of four undergraduate students managing the program with limited oversight provided by a Board of Governors. The board consists of faculty and staff from multiple disciplines across the campus.

This paper will present an overview of the program: including the management philosophy for both the funded program and the individual client projects. Also covered is a discussion of the underlying project objective – allowing students to run a project, with limited faculty oversight, in an effort to allow engineers to become better acquainted with the business world and more capable of effectively handling interactions between entrepreneurs and large companies. The main focus of the paper will be on the benefits and opportunities provided by allowing students to work on exciting new ideas and projects and on developing their own intellectual property in a multi-disciplinary setting. Specifically to be included are the interactions among different engineering disciplines, interactions between engineering disciplines and business disciplines from other schools, and how this will enhance the overall engineering education.

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Introduction

Entrepreneurs are not simply lucky; they are, however, very well educated and know how to recognize problems in the world as opportunities to start businesses. Engenius Solutions at Rose-Hulman Institute of Technology is a unique program that is beginning to make engineers recognize opportunities around them and giving them the education and support they need to capitalize on those opportunities.

The intention of the program is twofold: 1) to educate engineers on what it takes to run and market and organization like this in the business world, 2) to encourage engineers to submit ideas for new inventions for product development. Students that are employed by Engenius Solutions have the chance to gain real world experience in developing a new idea (in many cases an idea of their own) while still having access to the faculty expertise at Rose-Hulman and other schools that are working with Rose-Hulman. Engenius Solutions is running a pilot program this spring with Kelly School of Business at Indiana University. Engineers from Rose-Hulman will work with MBA majors to discover what it takes to do a feasibility analysis and marketing survey to study the market worthiness of an idea.

The intent of this partnership with the Kelly School of Business is that engineers and business majors will begin to work together on real world problems before they ever have to in the workplace. This type of hands on, practical education is inline with the laboratory style of teaching present at Rose-Hulman. The hope is that the more Engineers interact in a meaningful way with Business people, the better-rounded they are in their education and the better they will be able to function in the workplace. While Engenius Solutions' main focus is the development of new ideas, the student managers are also trying to get students to see how challenging, yet exciting it can be to be an entrepreneur in a fast paced technology field.

Organizational Structure

The program is funded by a three year grant from the Lilly Foundation in Indianapolis, IN. The institute was given money to hire student managers that would be in charge of dispersing money and resources to student inventors and entrepreneurs. Engenius Solutions is managed by four undergraduate students that reports to an oversight committee comprised of six staff and faculty members. The structure of the organization is quite simple. The CEO reports to the Board of Directors . The other three managers, Marketing Manager, Business Manager and Technology Manager report to the CEO. The Assistant Business Manager and all the Project Managers report to the Business Manager. All team members are supervised by a Project Manager.

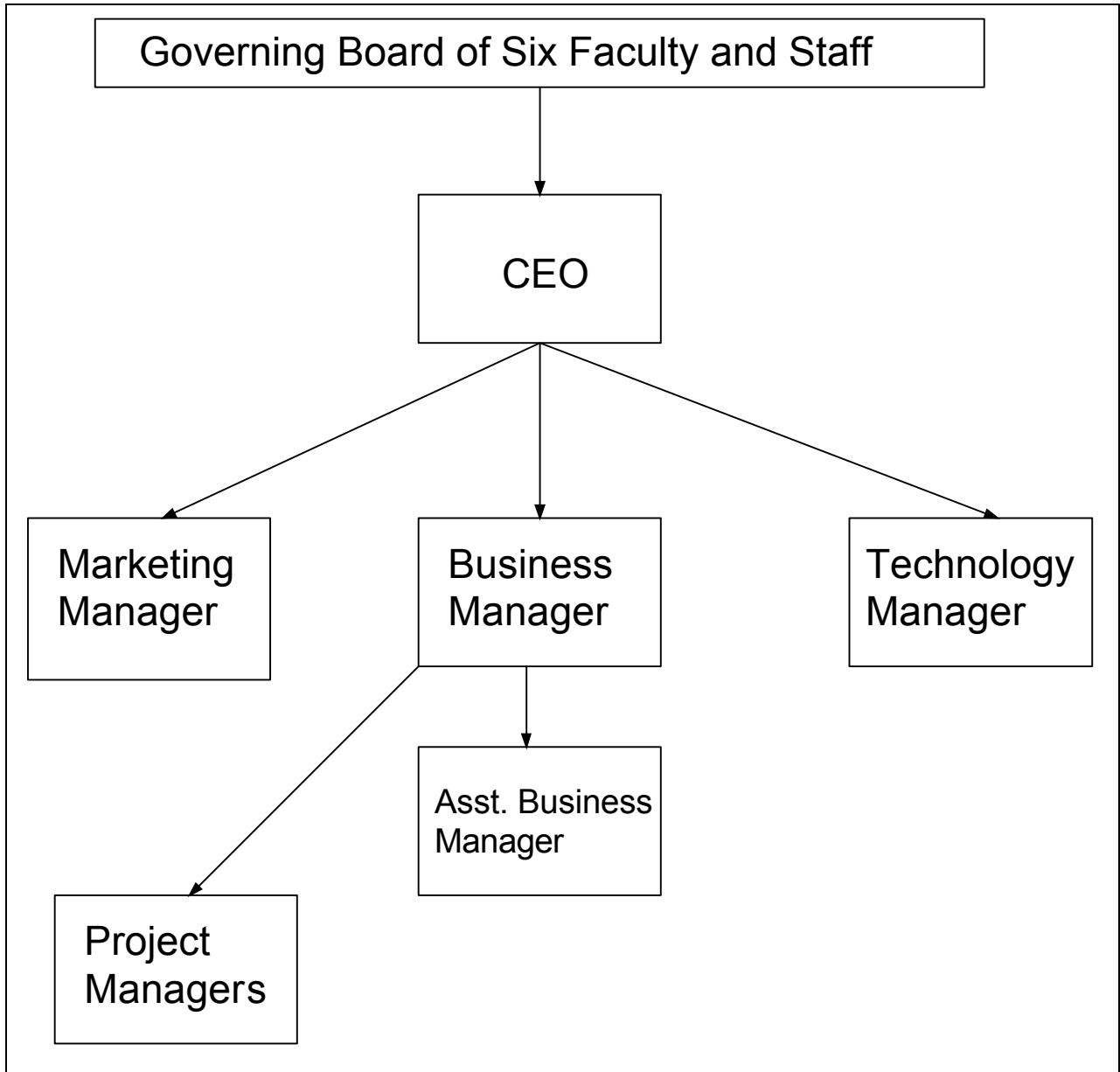


Figure 1: Organizational Structure

The CEO is in charge of the daily operation of the organization. He is responsible for managing the annual budget of over \$300,000. His main responsibilities include the successful operation and implementation of the program as well as being a spokesperson for the school and the organization in the academic and business communities.

The Marketing Manager is in charge of the implementation of the marketing plan for Engenius Solutions. The CEO and the Marketing Manager determine the marketing plan for Engenius Solutions on an annual basis with some longer term plans. The Marketing Manager is in charge of print, radio and broadcast promotion of the program. He works with an advertisement agency, the schools publicity director and his contacts within the media to promote the program to the

school and the Indiana community.

The Business Manager works with the project managers to ensure the successful development of the ideas being worked on by Engenius Solutions. His main duties include hiring team members to work on certain projects and soliciting and implementing new ideas for development by student teams. He interacts on a daily basis with team managers making sure they have the financial and technical resources to develop their ideas. The Business Manager acts as an intermediary between the management team and team members.

The Technology Manager (formerly the Web Manager) is in charge of all of the technical interfaces between project teams and Engenius Solutions, and the outside world—including the website. The Technology Manager is in charge of investigating new technologies and researching their direction and development. He formalizes opinions on which technologies are emerging and would be most successful after development by Engenius Solutions at Rose-Hulman.

All of the managers have responsibilities not only to their individual roles but also to the effective management of Engenius Solutions. The student managers meet weekly, sometimes more frequently, to discuss new project ideas and existing project's progress. They also make determinations on which new projects to accept and which existing projects to continue or to which more resources need to be allocated.

One of the main benefits to students of this program is their ability to make very important decisions concerning the development of new ideas. While the program is overseen by a faculty and staff board, students are the main managers of Engenius Solutions. Managers make determinations on which ideas to develop and at what stages different commercialization techniques begin. Student's exposure to this decision making process, while still having access to staff and faculty advisors, allows them to develop sound decision making principles. The ability for an engineer to make valuable business decisions is critical to any corporation or entrepreneurial venture.

Business Operations

Engineering Department Design Submission serves as excellent means of employee recruitment since the students are able to work on a credit based agreement. This allows Engenius Solutions to allocate money into other resources as opposed to a direct hiring scheme. A project that is designated as a department design submission normally has properties that are characteristic of one major concentration. Engenius Solutions submits the project to the appropriate engineering department and interested students are able to pursue the project for their engineering senior design. The student teams are selected within the course structure. Chosen teams then meet with Engenius Solutions to get a general overview of the initiative and the project on which they will be working. The student team is then able to meet with the Engenius client to further refine the vision and scope of the project.

Rose-Hulman Engineering students benefit directly from Engenius' design department project submissions. Each project submitted by the Engenius Solutions team is of the utmost importance

due to the impact our projects have upon our economic survival. More specifically, the work completed by each design department team has a direct relationship to both project and organizational success. While some design department teams may be involved in a project that is critical to some organization or company, every Engenius Solutions sponsored project is critical to our operation. Moreover, students are exposed to both the pressures and excitement of doing highly beneficial, marketable work.

Direct Hiring

Direct Hiring involves Engenius Solutions “advertising” the project being undertaken, as well as the students needed for the project. The career services office, specific engineering departments and targeted flyer advertisement are all sources of talent recruitment. The campus career services office serves as an excellent way to attract student interest. Career services gives Engenius Solutions instant credibility as an employment option of the student body, since most important corporate recruitment at Rose-Hulman Institute of Technology is initiated through the career services offices. Interested students are able to complete and submit an Engenius Solutions application via the website at www.engeniusolutions.com. The applications are then viewed and evaluated by the Engenius Solutions management team. A pool of qualified applicants are then contacted and interviewed by the management team. Based on our current needs, as well as applicant experience, the management team will fill a predetermined number of slots with successful applicants. It is an important goal to the initiative that the management team does not discriminate towards applicants due to the class year of the applicants. It is true of most engineering curriculums that upperclassmen will have the most in-depth project experience. Even if this is true, it is advantageous for us to hire bright, creative individuals who do not possess class based project experience, yet show the aptitude to learn and acquire new skills. This approach allows Engenius Solutions to organize teams that are fundamentally sound as well as adept at thinking creatively. Students that are in the Direct Hiring program are assigned a predetermined wage and are paid as an hourly worker. Direct Hiring allows Engenius Solutions to be in total control of student recruitment and rewards.

The ability to interview is a necessary skill in the corporate world. By implementing a rigorous interview process, Engenius Solutions ensures that quality students are retained, as well as providing all interviewees with a valuable learning experience that, quite possibly, will be encountered in future endeavors.

Development and Planning

The development stage is very important to the Engenius Solutions initiative. Engenius Solutions is focused on product development, so it is imperative that the organization produces quality. The management team believes that a quality product will emerge from a streamlined and effective development process.

Patent research is an integral part of the Engenius development process. It would be an extreme

waste of resources if a prototype was developed only to have a project's further progress limited by a patent infringement. Engenius Solutions has recognized this pitfall, and delegates internal and external resources to patent research according to project priority. Each development team is required to submit a detailed timeline highlighting important milestones and goals achieved. Engenius teams are also required to submit product design specifications and Gant charts for the project on which they are working. The aforementioned documents are then scrutinized by the Engenius management team to ensure that the specifications and workflow meet management and client requirements.

The development and planning stages are chances for students to learn about new product development and all of planning and development behind the creation of a successful new product. Engenius Solutions emphasizes detailed Product Design Specifications for each new idea before any prototype generation can occur. Each student development team must also have a good idea of prior inventions in the area of their technology. Engenius Solutions helps students research existing products and patents that are in their field of development so that the students might learn from previous products' successes and failures.

Creative, outside of the box thinking is championed in many engineering curriculums. Most new products have some innovative feature which sets them apart from their competition. Oftentimes, these innovations came after revisions, in which possibly better solutions to a problem existed. However, the better solutions may have resulted in a type of infringement. Engenius Solutions believes that engineering students need to be cognizant of the outside influences that may affect design decisions and solutions.

New Technologies Research

Technology is evolving very quickly. Engenius Solutions embraces technological advances and aims to integrate them, if possible, into our prototypes. New technologies research is undertaken for each accepted project. With this research, Engenius Solutions hopes to provide our developers and clients with the most current technologies. The creation of the Technology Manager will allow Engenius Solutions to focus on long range developments in technology and make formal opinions on which technologies are most promising for new product development. The formal opinion papers of an Engenius Solutions project will be available to all students at Rose-Hulman who are researching the future of technology. This research on the pace and path of technology will hopefully increase information available to student development teams and the student-at-large when they have questions about emerging technologies. The information that will be generated by Engenius Solutions will help better equip students with information on new technologies once they enter the work place.

Prototype Development

Successful prototype development is essential to our business model. Since Engenius Solutions primarily works with students at the undergraduate level, it is understood that technical issues may arise that supercede the knowledge of our developers. To avoid these technical pitfalls,

Engenius Solutions has set aside funding for outside consulting. This allows for our technical development teams to discuss development issues with an expert in a specific field of interest.

In order to ensure successful development, adequate work space and equipment are needed. Engenius Solutions has partnered with the John T. Myers Center for Technological Research on the campus of Rose-Hulman Institute of Technology. This facility provides lab space, as well as technical equipment access for Engenius developers.

As in the rest of the design process Engenius Solutions tries to simulate real world processes in prototype development. Testing is a crucial element in Engenius product development. The management team aims to deliver only the most reliable products to our clients. Each Engenius development team is required to provide and carry out a full testing plan, in order to ensure the integrity of our products. After thorough testing, a finished prototype is demonstrated to both the Engenius Solutions management team, as well as the client if appropriate. Engenius Development teams are judged exclusively on the product specifications outlined and submitted by each development team at the outset of the project.

Engenius Project Management Style

Engenius Solutions has gone to great lengths to ensure that quality students are chosen to be product developers. Our rigorous selection process allows us to truly have the students in charge of the product development. Student development teams are given much authority in the design of the products. Engenius development teams are required to submit bi-weekly project status reports indicating the current status of the project, problems encountered, areas that may be problematic in the future, and whether or not the team is currently on schedule.

Each development team has a notebook created to house all important team issues including the project definition and objectives, project pre-plan process, project budget, meeting agendas, project status reports, correspondence memos, and project notes and issues. The notebooks are updated on a bi-weekly time basis and are free to be viewed by all members of the Engenius management team. This open forum allows for knowledgeable and candid discussion among the Engenius management team members concerning the progress of each group.

Benefits to Students

It is our philosophy that students benefit greatly from hands on project experience. Lab based curriculum is an excellent medium for students to apply classroom theory. Engenius Solutions goes a step further by providing students “lab experience” which may result in a market breakthrough.

Marketing Overview

Marketing is one of the keys of success for any project or business. Without the proper marketing, great products and ideas can go unnoticed. But on the other hand, with proper marketing, innovative ideas are given a chance to flourish.

Within Engenius Solutions, marketing really plays two major rolls. The first is as a publicity entity that works to promote Engenius Solutions and what we do. This is important because as a new initiative of Rose-Hulman Institute of Technology we were relatively unheard of outside of the campus community. Therefore, one of the first objects of the marketing side was, and continues to be, to promote Engenius Solutions as resource when inventing new products as well as a source for new innovation.

The second responsibility of marketing at Engenius Solutions is to promote the individual projects that are developed by our student teams. This is one of the final steps in commercialization that Engenius Solutions plays a part in. With out this crucial step, the ideas developed would just sit on a shelf somewhere instead of being commercialized. The Marketing Manager is able to use his creativity and contacts to promote the idea of Engenius Solutions to the world. He gets a lot of real world experience in what it takes to actually market intellectual property from a new idea while trying to market the idea of Engenius Solutions as a way to do project based education.

Promoting Engenius Solutions

One of the areas that marketing focused on first was the promotion of Engenius Solutions. We recognized that a successful promotion strategy was an absolute necessity. Without one, our clientele would be severely limited. This would lead to fewer projects for students to work on. In addition, it was important for us to get our name out into the business community early. The reason for this being that when we approach a company in the future about licensing technology that Engenius Solutions had developed, we would like to have them be familiar with us and what we have to offer. Thus, our two main audiences are inventors and individuals and business looking for new ideas.

Early on we identified three major sources of publicity; these were alumni of Rose-Hulman, business journals, and conventions/conferences. These three sources would allow us to hit our target audiences more efficiently. A fourth avenue we pursued was the development of our website in such a way that it augmented our other marketing efforts by providing more detail about Engenius Solutions to those interested.

One of the major advantages of being connected to Rose-Hulman Institute of Technology is that it offered access to a well-educated and technology-based audience. This of course is their alumni. This provided an excellent foundation from which we could start our promotional campaign on. One of the first steps we took was to design and send out to alumni a direct mailer. Because of our affiliation with Rose-Hulman, alumni were more responsive, which has led to greater support.

In addition to the direct mailing, we have also had several articles about Engenius Solutions appear in the Rose-Hulman alumni newsletter, *Echoes*. These articles in turn have led to a greater awareness amongst the alumni.

The second source of publicity that we used was business journals. One main benefit that the journals afforded us is that they allow us to reach our target demographic on the commercialization side. This demographic would be business people who are in the position to

make decisions regarding the acquisition of new products and ideas, weather it be for a traditional company or a venture capital firm.

Early on we decided that it would be best to focus on the Midwest because of our location. Because of this, we have, or are in the process of running advertisements in such publications as *Indiana Business Journal* and *Indiana Business Magazine*. Our placement of advertisements in these publications has led to more referrals to our website, which has in turn led to some very valuable business contacts.

The third source of publicity that we have used is conventions and conferences. These two types of events have given us the chance to promote ourselves in person, which in turn leads to a greater exchange of information because we are able to have a two-way conversation. Through these events we have been able not only to be able to field new ideas, but also make business contacts that we can use in to future to promote our developed ideas.

The Website as a Marketing Tool

With such a remarkable service being offered to the Rose community and the Indiana region, Engenius Solutions needed a media that could efficiently inform prospective clients about what Engenius Solutions is and its status. It was decided that the best way to communicate with the widest range of audiences would be to use the internet. By creating a website, all information can be relayed to people at their own pace which can be accessed at any time virtually anywhere. Information is presented in a complete but succinct format that keeps the user interested and well informed. The website includes descriptions of how each service works and invites people to apply online. Applications are available for inventors, investors, and project mentors.

The website is laid out in a simple and direct way that is both practical and aesthetically pleasing. A professional atmosphere is maintained while keeping the viewer interested. The projects that Engenius is working as well as their status on at any given time can be viewed online. Should anyone have a question about any project, he or she could contact the Engenius Solutions team directly from the website without the need for third party e-mail software. Finally, Rose-Hulman student projects are displayed and even sometimes freely distributed via the website. By continuously updating the Engenius Solutions website, people can easily monitor the possibilities Engenius offers and can become an active Engenius Solutions participant.

Benefits to Students

Rose-Hulman students are an integral part of Engenius Solutions. The website is one of the most efficient means of keeping students informed and involved. Rose-Hulman students, however, are not the only ones who can benefit from the website. Students nationwide can log on and submit their own ideas, become part of a research team, or even just to find out what Engenius Solutions is trying to accomplish. Engenius partner schools' students, engineering or business, are able to stay informed according to their own schedules. Other potential students can follow Engenius's progress and then decide if they wish to become a part of the program. Engenius Solutions is run by students and ultimately benefits students; the website is an integral tool to facilitate the project.

Product Commercialization

As mentioned earlier, the second role of marketing is to promote the individual ideas that get developed at Engenius Solutions. There are audiences that we typically target when marketing an idea, they would be established businesses and venture capital firms.

Which avenue we decide to focus on depends predominantly on the originator of the idea. If the originator would like to try to start his or her own business, and we recognize their idea as one that can support a business model, we will focus our efforts on marketing the product to venture capital firms and individuals. On the other hand, if the originator would rather not invest the time it takes to start a business, we will then concentrate on selling that idea to an established company that would be looking to license or purchase that particular product.

One of the first steps we take towards commercializing a product is to identify the market leaders of similar technology, and also identify the venture capitalists that have traditionally invested in technology oriented businesses. This identification occurs almost immediately after we decide to accept a project.

When it comes to marketing a product to a company, we will wait until some design work has been completed on the project and a working prototype has been assembled. At that time we will begin to contact the companies that we identified as market leaders earlier. One thing that helps is that we will first look for alumni or other contacts we have made who would be in a position to help promote our idea. If no such person exists we will continue on with the marketing by contacting a person within the company who has control of purchasing new technology.

If instead the originator of the idea would like to try and start his or her own business we will then instead start to formulate a business plan that revolves around the product. In this case, we have been very fortunate in that we have a working relationship with the Kelly School of Business at Indiana University. Therefore, we have been able to draw upon the experience of several MBA students to help us draft those business plans and do feasibility analysis. The interactions between the MBA students and the undergraduate engineers have been successful in the fact that it allows business and engineering majors the chance to communicate to one another in a meaningful way. The inability of engineers to portray their ideas to business counterparts has long been a criticism of engineers' communication skills. Engenius Solutions is allowing these two disciplines to interact before they have to in the workplace and allowing them to figure out the best ways to communicate with one another.

Another valuable asset that we have been able to use when it comes to forming a business is Rose-Hulman Ventures, a technology oriented venture capital company that is apart of the Rose-Hulman community. Because we are both affiliated with the same university, we have been able to benefit one another. For example, when a product comes to the end of the development cycle there is a very good chance that we will be able to continue its commercialization further through Ventures. By the same token, we also act as a sort of pipeline for new business ideas for them.

This mutual relationship has afforded us many benefits.

At the time of the writing of this paper we are currently working on an additional vehicle that we can use to promote our projects. This vehicle is actually a board of advisors that we will regularly consult with regarding several of our projects. The board is comprised of individuals in management positions of various technology oriented companies located in and around the Indianapolis area.

The goal of this board of advisors is to provide us with a platform from which we can more effectively demonstrate the capabilities of our projects in hopes that a company who is represented will decide to further invest in one of them. Similarly, this board will benefit the companies represented because it will provide a source of new innovation that has been developed by a top-ranked engineering school. Students will also benefit with interaction with the board as they will be giving presentation to an audience of executives whom they have never met. Placing students in this somewhat uncomfortable position will help them become accustomed to giving presentations to an audience similar to what they might find in the work place. We will have the individual members of the board of advisors in place by early spring, with product demonstrations occurring before the end of the school year.

Benefits to Students

As was mentioned earlier, the ultimate goal of Engenius Solutions is to increase the value of the undergraduate education at Rose-Hulman Institute of Technology. The marketing aspect helps Engenius Solutions accomplish this goal by supplementing the engineering aspect of product development with the exposure to both business and product promotion.

While promoting Engenius Solutions as a business or initiative may not have a direct effect on the way an undergraduate student relates to the engineering profession, it does however provide a platform from which the marketing manager or any other member of the executive team can use to build a successful non-engineering endeavor. The hope is that it will help open the door to the possibility of a non-engineering career path by providing valuable experience while fostering the entrepreneurial spirit of students.

Perhaps the biggest gain in the education process is gained through the efforts needed to ring a product to market through effective marketing efforts. The experience an undergraduate engineering student will gain will help provide greater insight into the task of product development by allowing the student to see not only see the engineering that is required, but also the marketing efforts. This will help the student in future projects because they will not only be able to design a technically sound product, but one that is marketable as well.

Like most things in both education and industry, experience and insight is gained regardless whether the project was successful. Engenius Solutions looks to maximize the learning experience by providing an environment that fosters creativity by allowing students to make mistakes and learn from them. Therefore, regardless of whether a project is successful or not, the student will walk away with a greater understanding of the marketing aspects of product development.

Conclusion

The Marketing and Business operations are what make the whole Engenius Solutions program possible. The amazing fact is the whole program is managed by students. Their access to the various levels of the management of this entrepreneurial organization provides real world experience to engineers in the undergraduate years. The entrepreneurial and project management skills gained by the development of their own ideas are beginning to get engineers to think like entrepreneurs.