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BUILDING A COMMUNITY:
Refining the Robotics Innovation Competition and Conference

An Interactive Qualifying Project

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Degree of Bachelor of Science

by

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Abstract

This is an investigation to identify the necessary steps that need to be taken in the development of the Robotics Innovations Competition and Conference. These steps are those that will ensure that the RICC achieves its stated goal of building a strong community in the field of robotics engineering, featuring a lasting connection between academia and industry. Ensuring that the RICC fosters this community will be accomplished by identifying and anticipating the needs of the various parties involved in the RICC, specifically university professors, industry sponsors and representatives, and prospective student participants. This project aims to identify those needs through a combination of interview and survey techniques, and then, through qualitative analysis of the data collected, design ways to meet the needs of these three groups simultaneously. It is believed that doing so is necessary to fostering the community that the RICC aims to build.

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Executive Summary

The Robotics Innovations Competition and Conference (RICC) is a new robotics competition and conference to be held on November 7th and 8th, 2009 at Worcester Polytechnic Institute (WPI) in Worcester, Massachusetts. This is a new effort by WPI to create a new avenue to foster a community that includes both academia and the robotics industry by means of a competition. However, unlike the standard goals, tasks, and games typical of what one would expect in a robotics competition, the RICC aims to use a different approach, utilizing a more science fair-type style for the competition, while combining it with a conference portion. Currently, the RICC is preparing for its first competition, and will look to continue in subsequent years.

The focus question of this IQP asks "How does one execute a competition and conference so that it fosters a community that features strong involvement from both academia and industry?" This IQP looks for ways to tweak or otherwise make changes to the RICC such that it can more effectively build the community it intends to foster. By applying the general ideas of the concluded changes to other competitions, guidelines on how to shape a competition to help foster the community can be formed. In this situation, the RICC is to be used a case study in determining these guidelines. Although these changes cannot take effect for the first iteration of the RICC, these are things that can be applied in subsequent years. These proposed changes and tweaks are suggestions for both competitions and conferences that are trying to move forward from its initial holding.

Data was gathered for this IQP utilizing two main methods: interviews with faculty members and industry representatives that currently are seated on the RICC steering committee, and a multiple question survey that was administered to the undergraduate student body at WPI. Additionally, the official web site for the RICC went live during the course of the IQP, allowing the project team to gather hit statistics and visitor data for the web site. There were two other main issues that arose as the RICC started to mature and head into its next phase of participant applications. These issues were the funding for the event going forward, and how to accommodate participants from outside the New England area, for the RICC has garnered interest from people across the United States.

The results of this data showed that the RICC in its current form is sufficient as it is for its intended participants: students, academic institutions, and industry professionals. While there are changes that can be addressed in subsequent years, the RICC can remain as is for the near future. The motives for the robotics industry, academic institutions, and students for participating in the event are, for the most part, addressed or can be addressed by the RICC. As such, there are no major changes the project can suggest to the RICC steering committee that would affect the competition and the conference in the short term for this first annual RICC. The suggestions, however, can be taken into account by the steering committee as the RICC moves forward and looks to plan for its second iteration.

The suggestions offered by the project team as the final result of this IQP consist of four major points that can be applied to the RICC and competitions and conferences in general with the same goal. These suggestions focus on ways to maintain and grow the event, with ideas that are intended to be worked on through, during, and after the first iteration. One of the four suggestions fall under the guise of continuing to build interest in the RICC, by means of keeping

open channels with academic faculty and industry professionals. Two involve improving the RICC, by means of evaluating the RICC's first outing and developing new ways for students to interact at the event. The final suggestion is one for the future, where it becomes more of a goal for the RICC to become a standalone entity that is continued on the collective power of the groups that compose its community.

Focus Question

How does one execute a competition and conference so that it fosters a community that features strong involvement from both academia and industry?

1. Introduction

1.1. Robotics Innovations Competition and Conference

Worcester Polytechnic Institute will be hosting the first annual Robotics Innovations Competition and Conference (RICC) in the November of 2009. The RICC is a robotics competition created for collegiate-level student teams that will design and build original robots to meet criteria set by the RICC. This two-day event will also involve a symposium of speakers from both academia and industry who will deliver a mix of business and technology based presentations with the central theme of developing practical, useful, and commercially viable robotic applications. The competition will be judged primarily on the level of innovation and quality of engineering exhibited by the student teams. It is hoped that if the RICC can be designed so that it is both successful and sustainable, it will serve as an important segment in the growing robotics community and will help foster a working relationship between academia and industry.

1.2. Goals

Though commercial applications of robotics have existed for years, most notably in manufacturing, there has been a marked lack of involvement or widespread interest in the robotics industry surrounding new commercial applications of robotics. There exists a fledgling, primarily academic, robotics community to share and inspire ideas about robotics, but it is largely disjointed and has very few strong ties to the robotics industry. One of the goals of this IQP is to refine the development of the RICC so that it can be as successful both from a standpoint of sustainability, and from the standpoint of achieving its stated objective to foster a strong robotics community which incorporates both academia and industry. However, the major goal of this IQP is to develop a set of guidelines such that any field will be able to create and foster a community by means of a competition.

1.3. General Description of Methodology

The people who will be involved with the RICC, either as organizers of the event or as participants, fall into three distinct categories: industry representatives and sponsors, professors and the colleges and universities they represent, and the students who will participate in the competition portion of the RICC. For the competition to be sustainable, it must be designed and executed in such a way that these three groups benefit significantly enough from participating in the tournament that they feel that their participation was worthwhile. To ensure that the RICC

helps foster a strong community, it must be designed to create enough interaction between the three groups to form lasting ties that will exist beyond the tournament.

To achieve success and sustainability it is important to identify needs of each of the participating groups that the RICC is capable of meeting, and then design the RICC to meet those needs. Identifying these needs will be done largely by conducting research on the different participants (with particular concern to industry and participating schools) and by interviewing as many potential participants as possible. After identifying the needs of the different groups through research and interviews, solutions to meet the needs of each group can be designed.

2. Background

2.1. The Current State of the Robotics Innovations Competition and Conference

The Robotics Innovations Competition and Conference, set to take place on November 7th and 8th in 2009 at Worcester Polytechnic Institute, in its current form is a competition that has its student participants planning, designing, and creating robots using a supplied theme. In this first competition the goal for the participants will be to create innovative robots that will improve a person's or a group of persons' quality of life. The theme is created to be as open-ended as possible to allow for various different interpretations of the theme as entries in the competition.

Currently convening at least once a month is an external steering committee that makes decisions on all aspects of the RICC, including the following:

- Competition dates and deadlines
- Competition rules and safety rules clarifications
- Scheduling of events

The steering committee consists of primarily faculty from WPI, but also includes faculty from other academic institutions, along with robotics industry representatives from companies such as Foster-Miller, Heartland Robotics and iRobot. There is also an internal steering committee for the RICC, consisting of WPI faculty currently seated on the external steering committee.

The requirements for entry into the competition originally stipulated that participants must be involved in teams of at least three currently-enrolled undergraduate or graduate students, along with at least one advisor. In a modification to the rules of eligibility on February 20, 2009, team members will now need to be enrolled undergraduate or graduate students at the time of registration. There is an application that must be completed and submitted signifying intent to enter the competition, along with a progress report that must be submitted after the application but before the contest date. Teams must create a robot that complies with the given definition in the RICC guidelines: "A robot is defined as an electro-mechanical-computing system that senses and interacts with its environment." The robot must provide a service or perform a task that follows the theme of the competition, and it must have been reduced to practice within a year of the contest date. A functional prototype must be available at the time of the competition for demonstration purposes.

The RICC is planned as a two-day affair, with public browsing of posters and robot entries available throughout the first day until a formal poster session begins. The second day will be centered on the participants' presentations of their submitted work for the competition.

Alongside the competition-specific events, other activities are planned across the two days that are designed to stimulate interaction between the various participant teams and industry representatives. The extra events planned are:

- A series of informational seminars based on the various aspects of technology and business, including intellectual property and marketing methods
- A LEGO Design & Build breakout event involving LEGO toy building products, with the involvement of competition participants, attendees, and industry representatives. The goal for this event was to have members of the various student teams interact

2.2. Previous IQP

This project is a continuation of an existing IQP authored by Alexander Muir, William Hnath and Robert Breznak titled How to Plan a Robotics Competition on Campus, with the focus question: "What are the necessary developments in order to build a recurring community-based robotics conference and competition?" This previous IQP outlined the logistical steps needed to implement the RICC at WPI, which included the following:

- Criteria for the development of the RICC's vision statement
- Contacting the necessary people in a timely manner before deadlines are passed
- The identification of duties that must be delegated amongst the on-hand staff
- The creation of a website as a central repository for information for the public

While the crux of that IQP is not directly applicable to the answering of our focus question, the project is a factor of the RICC in its current form, and the development of the current focus question.

2.3. Participating Groups

There are many individuals that will be involved in the Robotics Innovations Competition and Conference throughout the life cycle of the event. They have been divided into three groups for the purposes of this investigation.

2.3.1. Participating Student Teams

These are students who will compete in the competition portion of the RICC. As the RICC is designed to be a collegiate level robotics competition, the participating students are expected to be pursuing degrees in robotics engineering or pursuing degrees in fields of engineering applicable to robotics. There will be undergraduate teams. Whether there will be graduate level teams or mixed undergraduate and graduate has yet to be determined. It is anticipated that many of the participating students will be seeking employment with industry representatives that will be involved with the RICC. As such, the event is being designed to maximize interaction between students and industry representatives.

2.3.2. Industry Representatives

Representatives from the robotics industry will have several roles to fill during the RICC. Currently, there are industry representatives on the RICC steering committee that are helping to make the RICC a reality. Industry representatives will also participate directly in the event, some acting as judges for the competition portion of the RICC and others serving as speakers during the Conference portion of the event. Acquiring sponsorship from industry is a high priority for those planning the RICC in order to fund the event and furnish prizes for the competition portion of the RICC.

2.3.3. Faculty of Participating Colleges and Universities

This group involves faculty that will serve as speakers during the conference portion of the RICC, and advisors to student teams. It is hoped that by identifying faculty at regional engineering schools that would be likely to participate in the RICC, the steering committee can form a working relationship with them and the faculty can encourage their students to participate in the RICC.

2.4. Existing Competitions

The RICC, while being one of the first to pursue an open-ended approach for its competition entries, is not one of the first large-scale competitions related to the fields of science and engineering or even robotics. There are multiple conferences and competitions that the RICC takes a decidedly different approach from, yet each of these events have their positive qualities that the RICC can draw from and the negative aspects the RICC can learn from.

One of the most nationally recognized robotics competitions is FIRST: the Foundation for the Inspiration and Recognition of Science and Technology. Its vision statement, as given by its founder Dean Kamen: "To transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology heroes." Expanding on that statement, FIRST's mission is to "inspire young people to be science and technology leaders, by engaging them in exciting mentor-based programs that build science, engineering and technology skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, communication, and leadership." FIRST uses a team-based competition that draws thousands of students throughout the United States, but however its competition themes are narrow in scope, unlike the RICC. However, the competition has had a large impact on its participants, with a Brandeis survey concluding that FIRST participants will most likely be involved in the science and engineering fields in the future.

Similar to FIRST is the BEST competition, whose acronym stands for Boosting Engineering, Science, and Technology. This middle/high-school competition has three distinct organizational goals:

- Promote the growth of hubs across the U.S., thus maximizing the "pipeline" of future engineers, scientists, and technical professionals.
- Increase participation of women and minority students in rural and inner city schools
- Enlist more colleges/universities and corporations to become collaborative educational partners with BEST

BEST uses the same type of competition as FIRST: the stereotypical type of robotics competition that will have robots compete against one another in an arena. However, BEST places an emphasis on other components with its BEST Award, which rewards aspects such as detailed log keeping and strong presentation skills.

The Singapore Robotics Games (SRG) is built around its four objectives:

- To inculcate in the general public an understanding and appreciation of robotics and automation
- To educate the general public on the things robots can do that are quite apart from industrial tasks

- To help in the technology development by providing benchmarks for practical robotics research and development
- To encourage innovation in design among young engineers and provide them with a forum to display their works

The competition is comprised of multiple games that are based on practical applications such as underwater operation and legged operation. This strikes a large similarity to the RICC's requirement of the development of a robot that will improve the quality of life. Neither evokes the image of the stereotypical robotics competition games.

The DARPA Urban Challenge (Defense Advanced Research Projects Agency) is focused on autonomous vehicle research and development, with the goal of keeping soldiers off of the battlefield and out of harm's way. It is a part of DARPA's Grand Challenge series of competitions, which featured an autonomous vehicle navigating a desert course. The Urban Challenge has the vehicles executing mock military supply missions in a city setting; the vehicle must be able to merge into traffic, navigate traffic circles, negotiate busy intersections and avoid obstacles to complete the mission. DARPA's competitions feature involvement from major academic institutions such as the Massachusetts Institute of Technology and Stanford University.

3. Methodology

The goal of this IQP is to create and foster a community that would feature strong involvement from two major spheres: the academic world and the industrial world. For the purposes of this project, the RICC will be used as a case study in order to provide a basis for the results and the direction of the project. The goal is to produce a set of criteria and suggestions that can be implemented by any competition to help foster a community in a desired subject matter. The methodologies that would be necessary to answer this project's focus question, "How does one execute a competition and conference so that it fosters a community that features strong involvement from both academia and industry?" can be classified into three distinct phases: identification, analysis, and solution.

3.1. Identification

In order to go about creating a community that did not exist or fostering a community that is in its infant stages, various factors need to be identified as to why such a relationship had not occurred before. With this identification phase, the project team aims to discern the issues that need to be met, achieved, and solved in order to achieve this IQP's goal.

3.1.1. Identifying the Needs of Industry

One of the proposed major pillars of this community is the related industry of the competition. In the RICC's case, it is the robotics industry that is the most pertinent to the competition. One of the goals of this identification phase was to determine the needs of the robotics industry that must be met to encourage its involvement in the academic community. This phase in the identification process was accomplished by interviewing members of robotics industry. Those interviewed were primarily the industry representatives that are involved in the RICC's steering committee.

The aim of the industry interviews was to ascertain the reasoning and extent of each company's involvement in the RICC. The needs of the robotics industry need to be determined to find out how to foster its involvement in the academic community. The questions that will be asked to robotics industry representatives are as follows:

- How did your company become aware of the RICC?
- Does your company sponsor other collegiate academic events such as the RICC?
- What is your company's intended involvement?
    - From a personnel standpoint?
    - From a financial standpoint?
- What does your company expect to gain by being involved in the RICC?
- Does your company place higher priority on, name recognition by being associated with this event, ideas for new innovations, or interaction with student teams?
- Do you have any goals for the RICC you would like to see met in order for your company to participate in this event annually?
- How do you foresee interaction between your company and RICC student teams playing out?

- What do you think the RICC can do to foster the relationship between your industry (and your company) and the academic community?

3.1.2. Identifying the Needs of Schools

Concurrent with building support from the robotics industry, the RICC aims to involve academia in forming this robotics community. Academic institutions will play a critical role in building this robotics community, as the RICC will be hosted and promoted primarily by engineering colleges and universities. Furthermore, it is reasonable to expect that student participation in the RICC will be highest from the institutions that are directly involved in the event. In order to encourage academic institutions to play a supporting role in the RICC, their needs that can be met by the RICC must be satisfied. Similar to the Identification phase for industry, the methodology for identifying the needs of schools was to conduct interviews with members of the academic community that are actively involved on the RICC steering committee.

The goal for these interviews is to determine the necessary developments and revisions to the RICC that will encourage engineering and technical schools to participate in the RICC and promote it to their students. The questions that will be asked are as follows:

- How did you hear about the RICC?
- What got you interested in the RICC?
- What ultimately led you to participate in the RICC at WPI?
- How much student involvement (academic and extracurricular) is there in robotics at your institution
- How much academic interaction do you and your colleagues have with other engineering schools?
    - Could you elaborate on that interaction?
    - What has caused that interaction to be either successful or unsuccessful?
- Do any of your (robotics) students have academic interaction with other engineering schools?
    - Could you elaborate on that interaction?
    - What has caused that interaction to be either successful or unsuccessful?
- What do you think can be done with the RICC to create/strengthen an academic relationship between the different robotics programs from each participating campus?
- What are you hoping involvement in the RICC would provide your robotics program?
- What do you think the RICC can do to foster the relationship between the academic community and industry?
- What is your school's vision for the future of their robotics program?
- What is your vision for the future of your school's robotics program?

In addition to asking these questions, further research will need to be conducted into each respective school's robotics programs. While none of these will be to the extent of WPI's robotics engineering major, the similarities and differences between all of the programs will need to be noted in order to gain further insight into how to attract schools to become involved in the RICC. As the goal of the RICC is to strengthen or create a community for robotics, playing into the strengths and the ideals of each institution will an important part to achieve that goal.

3.1.3. Identifying the Needs of Students

While schools are a valuable resource into creating and sustaining an academic community, it is the students of these institutions that have perhaps the most to contribute to and the most to gain from this community and are, in many ways, the lynchpin for the academic-industrial community that the RICC aims to create. Without students, the robotics industry loses a major incentive to participate- in the ability to network with young engineering students. It can also be expected that the RICC will gain minimal support from academic institutions if there is little or no interest from their student bodies. Student involvement in the RICC, and the community it aims to create, will be especially beneficial if the RICC can annually bring in new students into the community as well as retain students after they graduate as members of the robotics industry or academic community.

In order to gain an understanding of what prospective student participants want to get out of the RICC, a survey was sent out to the undergraduate student body of Worcester Polytechnic Institute. The survey was designed to gather the following data about potential participants in the RICC:

The questions that were asked in the survey were as follows:

- What year are you?
    - Answer choices were: Freshman, Sophomore, Junior, Senior, Graduate, Other
- What is your major?
    - Answer choices included all available majors at WPI
- How interested are you in a competition like this?
    - This question was prefaced with the following:
        - In November 2009, WPI will be holding its own original robotics competition and conference, with a focus on innovation in robotics and the creation of a community that would further this goal. The theme of this two-day competition is the creation of robots that will improve the quality of life. It is a college-level competition, with teams of three or more with an advisor able to participate. It will feature cash prizes and opportunities for interaction with the robotics industry along with robotics students from other schools. Teams will need to create, provide a written report about, and present their robot for this competition. There will also be talks given on various robotics industry topics, and a LEGO Design & Build Contest.
    - Survey takers were asked to rate their interest with the following scale: Strongly Uninterested, Uninterested, Neutral, Interested, Really Interested
- Please rate each of the mentioned aspects of the competition in terms of how each is appealing to you:
    - The nine aspects were the following:
        - Held in November 2009
        - Two-day competition
        - Robot creation
        - Competition theme
        - Cash prize
        - Robotics industry involvement

        - Other schools' involvement
        - Industry-related talks
        - LEGO Design & Build Contest
    - Survey takers were asked to rate each aspect with the following scale: Really Dislike, Dislike, Neutral, Like, Really Like
- Is there anything you would want added to this competition?
    - This question had an open-ended response
- Would you consider participating in a competition like this?
    - Answer choices were: No, For my MQP, For fun, For extra credit
    - Survey takers were also asked "Why or why not?" in an open-ended response
- If we may contact you for further information regarding this competition, please provide us your e-mail address:
    - Answer field was a text box where the taker could input his/her email.
    - The original intent for this question was to seek students that the project team could interview, but was not utilized

3.2. Analysis

Information about the needs of all three groups of participants in the RICC will be gathered from the identification phase. Data from all of the interviews, research, and surveys will be examined to identify issues pertinent to a single group or conflicts between two or more groups, and take that information into the next phase of this methodology. With the different types of questions being posed to the three groups, there will be certain things that will be looked for when analyzing the responses:

For schools, the key will be in figuring out how the RICC will fit in their current robotics or engineering program, and whether the dates that were agreed upon in the steering committee meetings for the RICC would allow them to participate in the competition. A school's schedule and program structure plays an important part in whether or not the school would be involved in the competition—if the RICC does not work for them, they will not participate. How each school sees the RICC as a possible opportunity for their students will also be looked at closely.

Incentives for industry to participate in the RICC must be identified. The reasons for robotics companies to participate in the RICC, and what they would hope to gain from this competition will be ascertained from the data collected in the interview process. With this set of responses, ways to make the RICC more attractive for companies to divert some amount of resources to this competition must be determined.

For students, the ways to make them want to participate in the RICC must be identified and established. Making the RICC attractive to a student is fundamentally different from making it attractive for a school or a company, as a student's participation consists of an entry into the competition rather than the facilitating the event.

There will be the occasion where there will be unexpected responses from any of the three groups of people that would provide further insight that the project team was initially not prepared to look for. Any issues raised by such a response would be further researched to ascertain its merits.

3.3. Solution

Once the various needs and issues raised in the identification and analysis have been identified, the IQP will move into the solution phase, determining the steps necessary to create and foster a community that will involve both academia and industry by providing solutions to the concerns raised by all those participating. It must be determined from the needs of the three groups of participants what the RICC will need to provide and implement, both immediately and in the future, to achieve its stated goal of creating an community centered on robotics. While the identification phase primarily focused on the RICC, the suggestions that will be made will be tailored such that it can be applied to other competitions outside the field of robotics.

It is possible that some of the need or desires of those involved with the RICC that are identified will be impossible to achieve or will directly conflict with another issue. When such a conflict arises, each need must be appropriately weighed and considered in the creation of the guidelines for this community. However, the project team will not prioritize one party over another, and will instead find the solution that provides a common ground for all three parties of industry, schools, and students.

3.4. Metrics for Success

The success of this project will largely be determined by the success of the RICC itself. Due to the fact that the RICC will not take place within the timeframe of this IQP, the most meaningful metrics for the success of this project are not observable at this time. Affirmative answers to the following questions will indicate some measure of success of this project and the RICC itself:

- Was the feedback from the three groups of participants—industry representatives, university faculty, and participating student teams—positive?
- Did a large number of student teams enter robots for the competition portion of the RICC
- How much sponsorship money was the RICC able to collect from industry?
- Did the conference portion of the RICC have high levels of attendance, both from RICC participants and members of the WPI community that were not direct participants in the RICC
- Will the RICC occur again the following year?

Naturally the answers to these questions will not be available at the conclusion of this project. However there are several benchmarks that have been set for this project that, if met, will indicate that the project is moving in the right direction. They are as follows:

- Did the methodologies described herein lead to the discovery of previously unidentified needs of the different participants (industry, faculty and students) of the RICC?
- Were solutions to meet the needs, both previously known and identified in this IQP, able to be devised?
- Were these devised solutions able to be implemented?

Our goals and metrics for success for the RICC as a competition and conference, which can be applied to other competitions, were as follows:

- High turnout of participating student teams

    - Multiple universities and institutions need to be represented
    - The more participants the better; there should not be a target number
    - The amount of participants who remain active in the RICC or community as members of industry after graduation
- Strong support from industry
    - The amount of sponsorship money obtained from the industry
    - The amount of material support, in the form of parts, that were obtained
    - The willingness of industry members to provide advisory support for student teams
    - The ability and willingness to host interesting and engaging talks about topics related to the industry
- Long term sustainability and growth
    - Positive amounts of sponsorship money and cash flow
    - Retaining participations from schools and companies from year-to-year
    - The amount of non-WPI personnel brought to the organizational side of the RICC
        - In terms of a more general competition and conference, how many members that were not previously affiliated with the initial committee have joined
    - The development of the RICC brand

4. Results

4.1. Interviews

4.1.1. Faculty

Interviews were conducted with six faculty members of different engineering schools, the majority being affiliated with Worcester Polytechnic Institute. Full transcripts of these interviews can be found in **Appendix A.** The faculty members that were interviewed were:

- Fred Martin, Associate Professor of Computer Science at the University of Massachusetts Lowell
- William Michalson, Professor of Electrical and Computer Engineering at Worcester Polytechnic Institute
- Taskin Padir, Assistant Professor of Electrical and Computer Engineering and Robotics Engineering at Worcester Polytechnic Institute
- Matt Stein, Assistant Professor of Engineering at Roger Williams University
- Grétar Tryggvason, Department Head of Mechanical Engineering at Worcester Polytechnic Institute
- James Van de Ven, Assistant Professor of Mechanical Engineering at Worcester Polytechnic Institute

Unlike the undergraduate student survey, which aimed to collect quantitative data to analyze what a 'typical' prospective RICC participant thought about the event, the faculty interviews that were conducted aimed to gather qualitative data from university professors that were already invested in the RICC in order to identify important, unresolved issues concerning the RICC. Some of the more pertinent issues that these interviews revealed were:

- The question of whether the RICC should be WPI-centric. That is, to say, branded as a WPI event.
- Should there be more emphasis on the conference portion of the RICC or the competition? How should the two portions of the event interact? Which does a better job at building the community?
- It is generally accepted among the faculty that the RICC will be a good opportunity for their students to be recruited for internships or full time positions. But is this really the case?
- Faculty indicated that student participation in the RICC would not be fully realized unless students can receive academic credit of some sort for participating

4.1.2. Industry

Interviews were conducted with four industry representatives who serve on the RICC steering committee. Full transcripts of these interviews can be found in **Appendix B.** The industry representatives who were interviewed were:

- Paul Brown of Hewlett-Packard

- Charles Dean of Foster-Miller
- Dave Matheson of iRobot
- Mikell Taylor of Bluefin Robotics

Like the faculty interviews, interviews conducted with industry representatives were not intended to collect quantitative data in order to analyze the 'typical' member of this group, but to identify important unresolved issues concerning the RICC. Some of the more pertinent issues that these interviews revealed were:

- Companies that are represented by those interviewed have made no material or financial commitment to the RICC
- The desire of companies to use the RICC as a networking and recruiting venue is not as high as expected.
- It is unknown what companies can be expected to contribute from a personnel standpoint, most of those who were interviewed are acting on their own behalf, and not on behalf of their company

4.2. Survey

On December 4, 2008, an electronic survey was released to the mailing list for undergraduate students at WPI. The survey was built using SurveyMonkey.com to design, host, and collect responses. 203 responses were collected from the survey as of February 3, 2009 for 11 questions relevant to the RICC, however, every question was not answered by every survey taker.

4.2.1. Interest in the Competition

198 survey takers responded to the first question, "How interested are you in a competition like this?". The method of response for the question was to pick one choice from a five-point scale, labeled the following:

1. Strongly Uninterested
2. Uninterested
3. Neutral
4. Interested
5. Strongly Interested

29 survey takers responded "Strongly Interested", which accounts for 14.6% of the total responses. 75 students responded "Interested", the highest total out of the five choices, accounting for 37.9%. There were 51 "Neutral" responses (25.8%), 33 "Uninterested" responses (16.7%) and 10 "Strongly Uninterested" responses (5.1%). As such, only 21.8% of responders (43 survey takers) answered negatively, meaning that they had picked either "Uninterested" or "Strongly Uninterested". Conversely, 52.5% of responders (104 survey takers) answered positively, picking either "Interested" or "Strongly Interested".

Out of the total 198, 56 survey takers signified that they were freshmen, 51were sophomores, 45 were juniors, and 41 were seniors. The majority of each of the four years chose "Interested" as their choice for this question, with 39.29% of freshmen, 35.29% of sophomores, 37.77% of juniors and 39.02% of seniors choosing the fourth response. 17.86% of freshmen (10

responders), 25.49% of sophomores (13 responders), 17.78% of juniors (8 responders), and 29.27% of seniors (12 responders) responded negatively, whereas 51.79% of freshmen (29), 56.86% of sophomores (29), 48.89% of juniors (22) and 51.21% of seniors (21) responded positively.

For majors, of the four that are directly related to the robotics program at WPI, the Robotics Engineering students showed the greatest interest in the RICC, with 84.62% of robotics students (22 of 26) indicating that they are interested in the competition. Mechanical Engineering students showed the second greatest with 62.16% (23 of 37) responding positively, followed by Computer Science students with 57.58% (19 of 33). Electrical & Computer Engineering students responded the least-favorably of the four, with 43.75% (7 of 16) responding either "Interested" or "Strongly Interested". Other majors responding with a notable positive response include Aerospace Engineering with 66.67% (8 of 12), Biochemistry, Biomedical Engineering, and Chemical Engineering each with 55.56% (5 of 9), and Civil Engineering with 50% (5 of 10)

4.2.2. Rating the Aspects of the RICC

The second major question of the survey briefly described the RICC, and survey takers were asked to rate each of the mentioned aspects of the competition, which were the following:

- The competition being held in November 2009
- The RICC being a two-day competition
- The creation of robots
- The competition's theme
- The cash prize awarded to the winner of the competition
- The involvement from the robotics industry
- The involvement of schools other than WPI
- The planned industry-related talks in the conference portion of the RICC
- The planned LEGO Design & Build Contest from the first day of the RICC

Survey takers were asked to rate on a scale of 1 to 5 how much they liked or disliked each aspect of the RICC, using these guidelines for the scale:

1. Really Dislike
2. Dislike
3. Neutral
4. Like
5. Really Like

4.2.2.1. Holding the Competition in November 2009

There were 200 responses for this aspect, with the majority belonging to the "Neutral" answer choice, with 68.5% of responders (137) selecting this choice. 21.5% of responders (43) selected "Like", while 2.5% (5) chose "Really Like", 4.0% (8) chose "Dislike", and 3.5% (7) chose "Really Dislike". In total, 48 survey takers (24%) responded positively (choosing "Like" or "Really Like"), while only 15 (7.5%) responded negatively (choosing "Dislike" or "Really Dislike").

By student year, 71.43% of freshmen (40 of 56) responded with “Neutral”, with 61.54% of sophomores (32 of 52), 72.34% of juniors (34 of 47), and 72.5% of seniors (29 of 40) doing the same. 14 freshmen (25%) responded positively, with 13 of those selecting “Like” as their choice. Likewise, 15 sophomores (28.85%, 12 “Like” responses), 12 juniors (25.53%, 12 “Like” responses), and 6 seniors (15%, 5 “Like” responses) answered positively.

There were no major differences across student majors for the most part, with the majority of selections being “Neutral”. There was one notable major, Robotics Engineering, where the results included 12 “Neutral” responses, composing 46.15% of those responses, and 11 “Like” responses, which composed 42.31% of Robotics Engineering responses.

4.2.2.2. Holding a Two-Day Competition

There were 199 responses for this aspect of the RICC, with the majority of responses being “Neutral” (102, 51.3%). 61 responders chose the “Like” answer choice, comprising 30.7% of the total responses. 15 responders (7.5%) answered with “Really Like”, while 18 responders (9.0%) answered “Dislike”, and 3 responders (1.5%) answered “Really Dislike”. In total, 76 responders (38.2%) answered positively, while 21 responders (10.5%) responded negatively.

Looking at the data by student year, each year sees similar splits to the overall totals. 30 (53.57%) and 14 (25%) freshmen (out of 56) responded “Neutral” and “Like”, respectively. Out of 52 sophomores, 24 (46.15%) responded “Neutral” while 19 (36.54%) responded “Like”. There were 26 “Neutral” responses (55.32%) and 16 “Like” responses (34.04%) for juniors (out of 47), and 18 “Neutral” responses (46.15%) and 11 “Like” responses (28.21%) for seniors (out of 39). 18 freshmen (32.14%), 25 sophomores (48.08%), 17 juniors (36.17%), and 15 seniors (38.47%) responded positively.

For student majors, results were mostly “Neutral”, and somewhat keeping in line with the overall totals. Some of the notable answer-splits came from responses from Computer Science, Mechanical Engineering, and Robotics Engineering. For Computer Science, 1 student answered “Really Dislike” (3.03%), 4 students answered “Dislike” (12.12%), 19 students answered “Neutral” (57.57%), 6 students answered “Like” (18.18%), and 3 students answered “Really Like” (9.09%). For Mechanical Engineering students, none answered “Really Dislike”, 4 answered “Dislike” (10.26%), 19 answered “Neutral” (48.72%), 14 answered “Like” (35.90%), and 2 answered “Really Like” (5.13%). Robotics Engineering had a radically different split across its answers, with 1 student responding “Really Dislike” (3.85%), 0 responding “Dislike”, 6 students responding “Neutral” (23.08%), 12 students responding “Like” (46.15%), and 7 students responding “Really Like” (26.92%).

4.2.2.3. The Creation of Robots

There were 199 responses for the robot creation aspect of the RICC, with 104 responding “Like” (52.3%) to constitute the majority. 44 responders (22.1%) answered “Really Like”, while 43 (21.6%) answered “Neutral”. There were 4 responses each (2.0%) for the answer choices “Dislike” and “Really Dislike”. In total, 74.4% responded positively, while 4% responded negatively.

From student years, each year kept similar ratios to the overall total, with only 1 or 2 people in each year responding negatively. 36 of 56 freshmen (64.29%) responded “Like”, while 9 each (16.07%) responded “Neutral” or “Really Like”. 25 of 51 sophomores (49.02%)

answered “Like” for this question, while 11 (21.27%) and 13 (25.49%) answered “Neutral” and “Really Like”, respectively. 21 of 47 juniors (44.69%) responded with “Like”, with 12 apiece (25.53%) responding “Neutral” and “Really Like”. Finally, 20 of 40 seniors (50%) responded “Like”, while 10 (25%) responded “Neutral”, while 9 (22.5%) responded “Really Like”.

For majors, the most interest came from the four-related majors to robotics at WPI: Computer Science, Electrical & Computer Engineering, Mechanical Engineering, and Robotics Engineering. There is also some notable interest from Aerospace Engineering, Biochemistry, Biomedical Engineering, and Interactive Media and Game Development majors.

4.2.2.4. The Theme of the Competition

There were 198 responses for the competition theme aspect for the RICC, which pertains to the creation of robots that will improve the quality of life. 94 of those responses (47.5%) were for the “Like” choice, while 41 responses were for “Really Like” (20.7%), leading to a total of 135 (68.2%) positive responses. 50 of the responses (25.3) were “Neutral”, while of the remaining 13 negative responses, 9 (4.5%) were for “Dislike” and 4 (2.0%) were for “Really Dislike”.

Going by student year, 27 of 54 freshmen (50%) indicated that he/she liked the competition theme, along with 29 of 52 sophomores (55.77%), 22 of 47 juniors (46.81%) and 15 of 40 seniors (37.5%). 12 freshmen (22.22%), 7 sophomores (13.46%), 7 juniors (14.89%), and 13 seniors (32.5%) picked “Really Like” as an answer choice. The “Neutral” answer choice was picked by 9 freshmen (16.67%), 13 sophomores (25.0%), 15 juniors (31.91%), and 11 seniors (27.5%).

For student majors, the competition was liked across all majors, with a few dissenting from those not-so-much enamored with the RICC itself. Some of the more notable majors were Aerospace Engineering, Computer Science, Electrical & Computer Engineering, Mechanical Engineering, and Robotics Engineering. For Aerospace Engineering, 8 out of 12 (66.67%) responded with “Like”, while 1 apiece (8.33%) for the remaining four answer choices. 13 of 33 Computer Science majors responded “Neutral” (39.39%), while 10 responded “Like” (30.30%) and 8 responded “Really Like” (24.24%). Out of 16 Electrical & Computer Engineering majors, 5 responded “Neutral” (31.25%), 9 responded “Like” (56.25%), and 1 responded “Really Like” (6.25%). For Mechanical Engineering, 9 out of 39 responded “Neutral”, 23 responded “Like” (58.97%), and 6 responded “Really Like” (15.38%). Of the 26 Robotics Engineering majors who responded, 2 answered “Neutral” (7.69%), 12 answered “Like” (46.15%), and 10 answered “Really Like” (38.46%).

4.2.2.5. Having a Cash Prize for the Competition

200 survey takers responded to the cash prize aspect of the RICC, with the majority consisting of 87 responders choosing “Really Like” as an answer choice, constituting 43.5% of the total. 76 responders (38%) indicated “Like” as their answer, with 30 (15%) indicating “Neutral”, 4 (2%) indicating “Dislike”, and 2 (1%) indicating “Really Dislike”.

22 of 56 freshmen (39.29%) chose “Really Like” as their answer, along with 26 of 52 sophomores (50%), 20 of 47 juniors (42.55%), and 15 of 40 seniors (37.5%). 20 freshmen (35.79%), 22 sophomores (42.31%), 18 juniors (38.30%), and 15 seniors (37.5%) picked “Like”

as an answer choice. Out of those who picked “Neutral”, 8 were freshmen (14.29%), 4 were sophomores (7.69%), 9 were juniors (19.15%), and 9 were seniors (22.5%).

There were no major discrepancies concerning the results by student major, as this aspect of the RICC was one that was well-liked by almost everybody. There are virtually no issues regarding the cash prize.

4.2.2.6. Involvement from the Robotics Industry

There were 201 responses for this aspect of the RICC, focusing on the intended involvement of the robotics industry. The majority choice was “Like”, which was picked by 76 survey takers (37.8%). 65 survey takers (32.3%) responded “Really Like”, leading to a total of 141 takers (70.1%) responding positively. 56 survey takers responded “Neutral”, or 27.9% of the total responses. 3 takers responded “Dislike” (1.5%), and 1 taker responded “Really Dislike” (0.5%).

The distribution among the four student years is different, but the majority of each was composed of positive responses. For freshmen, 14 of 56 responded “Neutral” (25%), 28 responded “Like” (50%), and 13 responded “Really Like” (23.21%). 11 of 52 sophomores responded “Neutral” (21.15%), whereas 19 responded “Like” (36.54%) and 20 responded “Really Like” (38.46%). For responses from juniors, 19 of 48 were “Neutral” (39.58%), 15 were “Like” (31.25%), and 14 were “Really Like” (29.17%). Out of 40 senior responses, 10 were “Neutral” (25%), 11 were “Like” (27.5%), and 18 were “Really Like” (45%).

This aspect was well-liked across the board when looking at responses by student major, with support even from non-directly-related robotics majors such as Biochemistry and Aerospace Engineering. Unsurprising, the most positive result was from Robotics Engineering, of which 20 of 26 responded “Really Like”, which is 76.92% of all Robotics Engineering majors who took the survey. Other notable results include 17 responses for “Like” (43.59%) and 15 responses for “Really Like” (38.46%) for Mechanical Engineering majors, and 14 responses for “Like” (42.42%) and 10 responses for “Really Like” (30.30%) for Computer Science majors.

4.2.2.7. Involvement from Other Academic Institutions

For the aspect of the RICC concerning participation of other academic institutions, there were 197 responses. The majority of the answers were for “Like”, of which 86 of the responses (43.7%) were for. 55 of the responses (27.9%) indicated “Really Like” as the answer of this question, leaving for a total of 141 positive responses, which is 71.6% of the total. 52 of the responses (26.4%) were “Neutral”, while there were two responses each (1%) for “Dislike” and “Really Dislike”.

The overall ratios for the most part hold when looking into the numbers by student year. 17 of 56 freshmen (30.36%) indicated “Neutral” in regards to this aspect, while 24 responded “Like” (42.86%) and 13 responded “Really Like” (23.21%). Out of 51 sophomores, 6 responded “Neutral” (11.76%), 26 responded “Like” (50.98%), and 18 responded “Really Like” (35.29%). From the 45 junior responses, 16 were “Neutral” (35.56%), 19 were “Like” (42.22%), and 10 were “Really Like” (22.22%). 12 of the 40 senior responses were “Neutral” (30%), 15 were “Like” (37.5%), and 12 were “Really Like” (30%).

As is the case again with this aspect, involvement from other academic institutions was favored across the board by all majors, part of which is attributed to the very few total negative

responses. As a notable statistic, for Robotics Engineering majors, 8 of 26 responded “Like” (30.77%), while 16 responded “Really Like” (61.54%).

4.2.2.8. Holding Industry-Related Talks

There were 200 responses for the aspect of the RICC regarding industry-related talks, with the majority of responses being “Like”, of which there were 86 (43%). There were 29 “Really Like” responses (14.5%), resulting in a total of 115 positive responses (57.5%). 75 of the responses were “Neutral” (37.5%), while only 9 were “Dislike” (4.5%) and 1 was “Really Dislike’ (0.5%).

Looking at the responses by student year, comparing the percentages of “Neutral” and positive responses provides vastly different ratios. 25 of 56 freshmen responded “Neutral” (44.64%), while 23 responded “Like” (41.07%) and 7 responded “Really Like” (12.5%). For sophomore responses, 15 of 52 were “Neutral” (28.85%), 25 were “Like” (48.08%), and 9 were “Really Like” (17.31%). 19 of 47 juniors responded “Neutral” (40.43%), while 22 responded “Like” (46.81%), and 3 responded “Really Like” (6.38%). From the 40 seniors who took the survey, 15 responded “Neutral” (37.5%), while 14 responded “Like” (35%), and 9 responded “Really Like” (22.5%).

For the responses by student major, it was liked-across the board with a few dissenting. However, the notable responses were not only from the Robotics Engineering majors, but rather also from Aerospace Engineering, Computer Science, Electrical & Computer Engineering, and Mechanical Engineering. Out of 12 Aerospace Engineering majors, 1 responded “Neutral” (8.33%), 8 responded “Like” (66.67%), and 1 responded “Really Like” (8.33%). From the 33 responses of Computer Science majors, 13 were “Neutral” (39.39%), 11 were “Like” (33.33%), and 8 were “Really Like” (24.24%). 4 of 16 Electrical & Computer Engineering majors responded “Neutral” (25%), while 11 responded “Like” (68.75%) and 1 responded “Really Like” (6.25%). 13 of 39 Mechanical Engineering majors answered “Neutral” (33.33%), 21 answered “Like” (53.85%), and 3 answered “Really Like” (7.69%). As for Robotics Engineering, 3 of 26 answered “Neutral” (11.54%), 14 answered “Like” (53.85%), and 9 answered “Really Like” (34.62%).

4.2.2.9. Holding a LEGO Design & Build Contest

For the aspect of the RICC concerning the LEGO Design & Build Contest, there were 197 responses, with the majority responding “Neutral”, with 70 responses or 35.5% of the total. 66 of the responses were “Like”, which is 33.5% of the total and 41 responded “Really Like”, which is 20.8%. This amounts to 107 survey takers responding positively, or 54.3%. 20 survey takers (8.2%) responded negatively, 12 of which responding “Dislike” (6.1%), and 8 responding “Really Dislike” (4.1%).

While none of the 55 freshmen who answered this question responded “Really Dislike”, there were 5 that responded “Dislike” (9.09%). 20 freshmen responded “Neutral” (36.36%), while 22 responded “Like” (40%) and 8 responded “Really Like” (14.55%).2 of 52 sophomores responded “Really Dislike” (3.85%), while 5 responded “Dislike” (9.62%). 16 sophomores answered “Neutral” (30.77%), as 20 answered “Like” (38.46%), and 9 answered “Really Like” (17.31%). Of the 45 junior responses, there were 2 each (4.44%) for “Really Dislike” and “Dislike”, 18 for “Neutral” (40%), 12 for “Like:” (26.67%), and 11 for “Really Like” (24.44%).

4 of the 40 senior responses were for “Really Dislike” (10%), but there were none for “Dislike”. 16 of those responses were “Neutral” (40%), 8 were “Like” (20%), and 12 were “Really Like” (30%).

There was a mixed reaction in the responses by major, although for the most part many were leaning towards the positive side of the spectrum. Again, Aerospace Engineering, Computer Science, Electrical & Computer Engineering, Mechanical Engineering, and Robotics Engineering were the notables. For Aerospace Engineering, 6 of 12 responded “Neutral” (50%), 4 responded “Like” (33.33%), and 2 responded “Really Like” (16.67%). The 32 Computer Science responses were more varied, with 5 responding “Really Dislike” (15.63%, 2 responding “Dislike” (6.25%), 13 responding “Neutral” (40.63%), 8 responding “Like” (25%), and 7 responding “Really Like” (12.5%). From the 15 Electrical & Computer Engineering responses, there was 1 each (6.67%) for “Really Dislike” and “Dislike”, 6 for “Neutral” (40%), 5 for “Like’ (33.33%), and 2 for “Really Like” (13.33%). Of the 38 Mechanical Engineering majors who responded, none responded “Really Dislike”, 1 responded “Dislike” (2.63%), 11 responded “Neutral” (28.95%), 15 responded “Like” (39.47%), and 11 responded “Really Like” (28.95%). For the 25 Robotics Engineering majors who responded, 1 answered “Really Dislike” (4%), 5 each (20%) answered “Dislike” and “Neutral”, 12 answered “Like” (48%) and 2 answered “Really Like” (8%).

4.2.3. Possible Additions or Changes to the RICC

The third major question of the survey asked, “Is there anything you would want added to this competition?” There were 21 responses, which range from “Nothing” to some various concerns with what was divulged in the survey. 6 of the 21 responses amount to the former answer type, leaving 15 viable responses with varying suggestions. Some of the responses were small, noting things like the desire for a later date, or the idea that food items should be provided.

One of the more common responses was the creation of a set of tasks that the robot should perform, and competition-related suggestions such as the balancing of teams and various restrictions on equipment. A couple were geared towards the LEGO Design & Build Contest, of which VEX parts was suggested as an alternate. However, it is suggested that the theme for the RICC remain fresh, and that WPI also use this opportunity to showcase its robotics projects done by its students.

4.2.4. Reasons for Participating in the RICC

The fourth and last major question of the survey asks “Would you considering participating in a competition like this?”, and gives four responses, of which more than one can be selected:

- No
- For my MQP
- For fun
- For extra credit

202 survey takers answered this question, with 1 electing to skip.

4.2.4.1. Do Not Want to Participate

75 of the 202 survey takers who answered this question responded “No”, amounting to 37.1% of all those who responded. The distribution by year is even, with 18 freshmen responding as such, and 19 each of sophomores, juniors, and seniors stating that they do not wish to participate in a competition like the RICC. Looking at the data by major, no Robotics Engineering students answered “No” to this question, while 10 Computer Science and 12 Mechanical Engineering students did.

4.2.4.2. Want to Participate for MQP

45 of the 202 survey takers who answered this question responded “For my MQP”, which is 22.3% of all those who responded. From the distribution of data by student year, 6 of those who responded this way were freshmen, 12 were sophomores, 14 were juniors, and 10 were seniors. Also, the one graduate student who took this survey also responded this way, along with the one student who specified his/her year as ‘Other’, and another who did not specify his/her student year. The notables from the student major distribution include 11 Computer Science, 7 Electrical & Computer Engineering, 9 Mechanical Engineering, and 13 Robotics Engineering students. There is also some interest from Aerospace Engineering, Chemical Engineering, and Management Engineering students.

4.2.4.3. Want to Participate for Fun

98 of the 202 survey takers who answered this question responded “For fun”, which is 48.5% of all those who responded. Looking at the student year distribution, 34 freshmen, 25 sophomores, 19 juniors, and 17 seniors responded in this way, along with the two survey takers who identified themselves as ‘Other’, and the one student who did not specify. From the major distribution, there are seven notables: 7 Aerospace Engineering, 5 Biochemistry, 5 Chemical Engineering, 18 Computer Science, 8 Electrical & Computer Engineering, 25 Mechanical Engineering, and 21 Robotics Engineering students.

4.2.4.4. Want to Participate for Extra Credit

80 of the 202 survey takers who answered this question responded “For extra credit”, which is 39.6% of all those who responded. From the student year distribution, we see that 24 freshmen, 21 sophomores, 19 juniors, and 14 seniors answered this way, alongside the one graduate student and the one student who did not specify his/her year. From the major distribution, 6 Aerospace Engineering, 14 Computer Science, 8 Electrical & Computer Engineering, 19 Mechanical Engineering, and 20 Robotics Engineering students indicated their interest in this form.

4.3. RICC Website

On November 24, 2008, the official website for the RICC went live, allowing users to browse information about the competition and register their e-mail address for future contact and additional information. WPI Professor Taskin Padir attended a conference this November in which a flyer with the URL for the RICC website was distributed. Additionally, Mikell Taylor of Heartland Robotics had posted an article concerning the RICC on the IEEE Spectrum blog, directing readers to the competition's website to register for the aforementioned mailing list. As a result of this blog post, news about the RICC also made its way to the Chief Delphi forums, a platform for discussion of the FIRST robotics competition.

Registration for the competition officially opened on February 5, 2009, in a mass e-mail sent by Professor Richard Beach. The website link was posted in the thread about the competition on the Chief Delphi forums by Mikell Taylor. The RICC is also advertised on the website for the 2009 IEEE International Conference on Technologies for Practical Robot Applications (TePRA). Each of these websites contributed its own hits and garnered interest for the competition by those who had followed the links.

Starting from October 1, 2008 until March 5, 2009, there have been 14,650 unique hits from non-WPI domains. In that timeframe, 250 visitors were referred from Mikell Taylor's IEEE Spectrum blog. Additionally, there were 32 visits from the Chief Delphi forums and 15 visits from the TePRA 2009 website. Due to the RICC website being developed here at WPI, the total amount of genuine hits by people who are interested in the RICC cannot be ascertained.

The website hits come from domains across the United States and some in foreign countries. Some of the academic institutions that have had a notable amount of hits include:

- Carnegie Mellon University
- Clarkson University
- Georgia Tech University
- Massachusetts Institute of Technology
- Olin College of Engineering
- Oregon State University
- Polytechnic Institute of New York University
- Rensselaer Polytechnic Institute
- Rice University
- Smithsonian Institution
- Stanford University
- Stevens Institute of Technology
- Tufts University
- University of Pennsylvania
- University of Texas at Austin

Likewise, some of the company domains that have provided hits to the RICC website include:

- The Boeing Company
- DEKA Research & Development Corporation
- IBM
- General Motors
- National Instruments

5. Analysis of Results and Solutions

5.1. Interview Analysis

A major issue that came to light as a result of the faculty interviews was how much focus there should be on the RICC as a WPI event. This issue arose in a steering committee meeting during discussion of whether the RICC logo should include WPI's own logo. Fred Martin, a Computer Science professor at the University of Massachusetts Lowell, raised a concern that including WPI in the logo conflicted with the mission statement of building an academic community that is broader than the WPI community. This issue was further emphasized in interviews with WPI faculty who felt that the RICC would be a platform for showcasing WPI's robotics engineering program, and it became apparent that there was a disconnect between WPI and non-WPI faculty.

There is a case to be made both for and against branding the RICC as a WPI event as well as the larger question of whether the WPI should be the sole host of the event or if the RICC should rotate hosts on an annual basis. Reasons for WPI-centricity include:

- WPI has done the majority of the organizational legwork for the RICC.
- WPI leads the way in undergraduate robotics education, hosting the RICC at WPI gives other institutions the opportunity to learn about WPI's program and use that knowledge to bolster their own programs. This is certainly conducive to building an academic community.
- The RICC has not yet reached a level of sustainability where it is likely to succeed without the direct support of WPI.

The reasons, however, against WPI-centricity include:

- The mission statement of the RICC is not to showcase WPI's robotics program, but to build an academic community, giving other institutions an ownership stake in the RICC is more likely to increase participation of other institutions.
- Faculty of other institutions indicated that they would be less willing to support the RICC if it is branded as a WPI event.
- Hosting the RICC only at WPI limits its influence from a geographic standpoint to the Northeast.

The proposed solution to this conflict is to host the RICC at WPI for the next several years, followed by the implementation of a rotating host system. This solution allows the RICC a period of time at WPI where it can grow to a self-sustaining level, and gives ample time for WPI to showcase its robotics engineering program, yet it still allows for other institutions to have an ownership stake in the event, which is believed will improve participation from other schools, and allows for the RICC to eventually grow beyond the Northeast.

Another issue that was brought to light in the faculty interviews is that it is essentially unknown which portion of the RICC, the competition or the conference, would do a better job at building an academic-industrial community. Since the primary goal of the RICC is to build such

a community, knowing which aspect of the RICC is more effective in community building is important to correctly allocate resources and emphasis to the conference and the competition. Until the first RICC actually takes place, this is difficult to know with certainty. However, enough is known that a general strategy can be developed. For instance, the competition portion of the RICC is novel in that currently no robotics competitions exist at the collegiate level with the same science-fair format that the RICC has. Emphasizing this novelty to all three groups of interest (faculty, students, industry representatives) is likely to increase potential involvement in the RICC.

Another strategy that can be developed from current knowledge is that, since competition participants are already expected to attend the conference, the conference portion of the RICC can simultaneously be advertised as part of the larger RICC and as an event in and of itself. This has the potential to increase the attendance of the conference, as well as increase awareness of this portion of the RICC. The RICC currently allows for registration of conference attendees alongside participants for the competition.

Finally, the overall strategy for community building during both portions of the event should involve promoting interaction between everyone present at the RICC. This includes limiting one student presenter per project at a time during the competition (with exception during the judging phase) to allow students to interact with other teams, and encouraging speakers from both academia and industry to interact with each other as well as their audience by providing a forum beyond the standard question-and-answer sessions that are typical at academic conferences.

An issue regarding student participation was raised during the faculty interviews. Specifically, it was suggested that student participation in the RICC would not be fully realized if the competition is not designed in such a way that students can receive academic credit for their work. The most logical way for students to receive academic credit for the RICC is to incorporate their RICC entry into an independent study project or senior capstone design project. Given this, the RICC should be advertised directly to schools as a potential Independent Study Project or Senior Capstone project. Furthermore, the date of the RICC should be conducive to the timing of a Senior Capstone. Currently, the timing of the RICC is not ideal for most institutions, as the November competition date requires that the entry be designed and built sometime between the middle of spring semester and the middle of fall semester, rather than during the course of the school year.

An issue that came up in both the faculty and industry interviews was the role the RICC would play as a venue for networking and recruiting between students and companies. It was generally accepted by faculty that the RICC would serve as a means for companies to recruit students and that this aspect of the event would have a positive effect on participation of both students and companies. While the industry representatives we interviewed were not opposed to the idea of networking with students, this was not necessarily a high priority for them. Given the currently bleak job market, and that companies will not likely be actively recruiting, it is important that throughout the RICC students are given every opportunity to network and interact with the industry representatives.

One of the most disconcerting issues that arose during the interviews conducted with the industry representatives was the marked lack of definitive personnel, material, and financial support that companies have thus far committed to the RICC. Currently, the only confirmed personnel support from the robotics industry is the four active industry representatives on the steering committee. When asked what sort of support the RICC could expect from their

respective companies, those interviewed responded that beyond their own personal support, there were currently no plans for further support from the companies they represent. Given the finite nature of the RICC's NSF funding, it is imperative that the RICC moves towards garnering more concrete support from industry. The most common reason that interviewees reported for supporting the RICC in the first place was a desire to play a supporting role in the education of young engineers, more so than name recognition through sponsorship. This is something that should be kept in mind when approaching companies for financial support, especially given that name recognition alone is not likely to be a large incentive for companies to give their support, because the RICC is a new and untested event.

5.2. Survey Analysis

5.2.1. General Responses

The survey sent out to the WPI Undergraduate mailing list allowed the project team to identify the interests and concerns of students at WPI, and whether or not any changes need to be made to the RICC. In designing the survey, four things were considered when trying to identify student needs for the RICC:

- Whether there is interest or not in the RICC
- How do each of the planned aspects of the RICC resonate with students
- Is there anything that could be added to the RICC in its current form
- Reasons why the student would or would not participate in the RICC

From the results of the survey, there is no need to drastically change the RICC in its current format to coincide with the needs and desires of students.

The first question in the survey asked "How interested are you in a competition like this?", following a short description of the RICC, and could be answered with five possible answer choices: "Strongly Uninterested", "Uninterested", "Neutral", "Interested", "Strongly Interested". According to the results, the majority of survey takers picked "Interested", which is also the case when sorting the data by each student year. With each class having similar percentages of "Interested" and "Strongly Interested", we can assume that interest in the RICC is something that is independent of the year in school the student is currently in. This also takes into account that in the description of the RICC in the survey, it was noted that the competition was to be held in November 2009, which did not deter any senior students taking the survey.

Unsurprisingly, most of the interest in the RICC came from Robotics Engineering students, with 22 positive responses ("Interested" or "Strongly Interested") out of a total 26. Interest also came from the robotics-related majors of Computer Science (19 of 33 positive) and Mechanical Engineering (23 of 27 positive), but not so much Electrical and Computer Engineering (7 of 16 positive). However, there had been some surprise interest in other majors: Aerospace Engineering (8 of 12 positive), Biochemistry (5 of 9 positive), Biomedical Engineering (5 of 9), Chemical Engineering (5 of 9 positive), and Civil Engineering (5 of 10 positive). With these results, it may be possible to attempt to market the RICC to majors outside the expected four (Robotics Engineering and the three majors that it is comprised of), to increase the exposure of the RICC and build the community.

The second question asked survey takers to "Please rate each of the mentioned aspects of the competition in terms of how each is appealing to you", with nine aspects that could rated with one of five answer choices: "Really Dislike", "Dislike", "Neutral", "Like", "Really Like". Each of the nine aspects of the RICC inquired about in the survey look at the competition before it had been officially announced to the public on February 10th, 2009. These nine aspects are the following:

- The competition being held in November 2009
- The RICC being a two-day competition
- The creation of robots
- The competition's theme
- The cash prize awarded to the winner of the competition
- The involvement from the robotics industry
- The involvement of schools other than WPI
- The planned industry-related talks in the conference portion of the RICC
- The planned LEGO Design & Build Contest from the first day of the RICC.

For the first aspect of the RICC regarding that the competition will be held in November 2009, the majority of survey takers were neutral, with 137 of 200 responding as such. 48 students responded positively ("Like" or "Really Like"), while 15 responded negatively ("Dislike" or "Really Dislike"). When sorting the responses by student year, this majority still holds across each student year with freshman, sophomore, and junior-year students. However, a larger majority of senior-year students expressed the "Neutral" answer choice. This is expected, as this November timeframe does not fit in the schedule of the seniors who intend to graduate this spring. This "Neutral" preference also applies when looking at the data by student major, showing that the competition can indeed remain in this time frame.

As a note, this survey had been conducted before the RICC steering committee had announced that the RICC would allow students who have matriculated in that year to participate in that year's competition with their team. However, given the date that this survey was administered to WPI's undergraduate students, this point is rendered moot for this year's senior class, as many, if not all, already have or working on their MQP. For this year's juniors, the timeframe to try and accommodate this November timeframe for the first RICC can prove to be too soon, and would force the student team to work over the summer months with short notice. However, public knowledge of the RICC and known expected timeframes of future iterations of the competition can alleviate this problem.

The second aspect of the RICC concerned the competition's current two-day format, and the majority of survey takers responded "Neutral", with 51.3% of the total doing such. Additionally, 38.2% of all survey takers responded positively for this aspect. The responses sorted by student year and major for the most part matched the overall divisions in terms of distribution. Therefore, it can be assumed that the two-day format for the RICC is something we can keep as of right now.

The RICC's primary methodology and the third competition aspect was the creation of robotic entries for the event. Nearly 75% of all survey takers answered positively for this question, coupled with 21.6% of takers choosing the "Neutral" answer choice. This is also reflected in the breakdown by student year, with each year only showing little dissention from this aspect. For student majors, the four directly-related majors to robotics, Computer Science, Electrical & Computer Engineering, Mechanical Engineering, and Robotics Engineering had the

best results, as expected, showing that there is a group at WPI that would enjoy building robots. Trying to market the RICC to other notable majors with positive results, such as Aerospace Engineering and Biochemistry could prove worthwhile, given some of the interest.

The competition theme of the RICC is to produce robots that would improve the quality of life, and is the fourth aspect that was surveyed. Like with the robot creation aspect, there were very few negative opinions on the subject, with 6.5% of responses being negative. The majority of responses were positive, while 25% responded "Neutral". With this, it is safe to believe that the current competition theme is something that possible participants will be willing to make entries for. As this is also reflected when sorting the data by student year and major, this is one of the more ideal themes for the RICC. However, to keep things fresh, changing the specifics of the theme would be helpful to maintain interest at a later date or future competition.

For the fifth aspect of the RICC, survey takers were asked to rate how they value a cash prize as a reward for the winners of the competition. With the majority of survey takers responding that they "Really Like" the prospect of winning a cash prize, this is something that should be kept in the RICC. There were very few dissenting opinions among the survey takers, when looking overall at the data, and when sorting by student year and major. The cash prize can be seen as a valuable incentive for participation in the RICC.

The sixth aspect of the RICC concerned one of the major pillars of the event: the robotics industry. An overwhelming majority of those who responded to this aspect did so positively, with 70.1% choosing "Like" or "Really Like". There are very few dissenting opinions, with only 4 survey takers choosing "Dislike" or "Really Dislike". These results show that the student participants would welcome the robotics industry as part of the RICC and the community.

Involvement from other academic institutions was the seventh aspect of the RICC that was surveyed. As with the previous aspect, an overwhelming majority responded positively to this, with 71.6% doing so in this case. Again, there were very few dissenting opinions, which 2% of all responses being negative. These ratios also hold when sorting the data by student year and major. Given this information, like the robotics industry, we can assume that student participants would also welcome other schools as a part of the RICC and the community.

Brought up as the eighth aspect of the RICC to be evaluated were the robotics industry-related talks that would be given on the first day of the competition. 68.2% of the responses were positive, while only 6.5% were negative. Sorting by student year also brings the same results as the overall. When looking at the data by student major, while it is understandable that Robotics Engineering majors would like these talks, other majors have shown interest. These talks would be beneficial to any and all participants of the RICC, and the interest shown by Computer Science, Electrical & Computer Engineering, Aerospace Engineering, and Mechanical Engineering majors can allow for these talks to branch out to topics that relate to both robotics and each of these majors.

The ninth and final aspect surveyed about for the RICC was the LEGO Design & Build Contest that had been planned for the end of the first day of the competition. A little more than half of the responders answered positively for this contest, with 10.2% responding negatively. With mixed responses when looking by student year and major, the LEGO contest could be received well at the first RICC. There is, however, a mediocre reception in regards to this based on the survey results, despite the majority being either neutral or positive. The LEGO Design & Build Contest should be one of the aspects of the RICC that is evaluated following its completion.

The third question asked survey takers whether there was anything that they wished to add to or change about the RICC. One of the responses was geared toward the LEGO Design & Build Contest, and how it should not be used for a college-level competition. Another response suggested the use of VEX parts as an alternative to LEGOs. There were also ideas given to keep the competition theme fresh, and have WPI use the RICC to showcase its students' robotics projects. While these accommodations can be done for the RICC, other things that were brought up, such as the request of a set of tasks and team balancing cannot be implemented.

From the responses to the third question, however, we can gather that an alternative to the LEGO Design & Build Contest should be created. Like changing the competition theme, changing this contest can keep the conference portion of the RICC fresh. As the original intention for the LEGO Design & Build Contest was to be a socialization session at which student participants could interact, constructing other methods of interaction would have two positive effects for the RICC. The first of these effects is that it strengthens the conference portion of the RICC by promoting some interaction and discussion. The other effect is that these methods of interaction can provide a way to help the community that the RICC is trying to foster become more cohesive by trying to break the barriers between people.

The last major question of the survey focused on the survey takers' reasons for participating in the RICC if they had expressed interest. Four different responses were selectable: "No", "For my MQP", "For fun", and "For extra credit". With this question, the goal is to determine ways to market the RICC to students, in order to enhance participation in the competition. There is enough interest in the RICC such that it can attract from different groups of students for different reasons. The four robotics-related majors each had shown impressive interest in wanting to participate in the RICC. Other notable mentions such as Aerospace Engineering, Biochemistry, and Chemical Engineering students also show that there is at least some interest in wanting to take part in the competition outside of the four main majors. Understandably, Robotics Engineering majors want to participate for whatever reason, whether it would be for their MQP, enjoyment, or extra credit. With similar interest being shown from Computer Science, Electrical & Computer Engineering, and Mechanical Engineering students, the RICC can be safely marketed to the students of these majors.

Initially we had expected that the majority of students would mainly use the RICC as a means to do their MQP. However, there was also much interest in wanting to participate in the competition for fun or for extra credit—possibly as an Independent Study Project (ISP). As such, while the RICC can not only try to market itself for those looking for a MQP or senior project, it can try to appeal to those wanting to participate in the competition for other reasons, whether it be as part of a club or for credit that students can apply to their degree requirements. In the case for here at WPI, the RICC can try to reach out to those who have participated in or are affiliated with the FIRST competition, to groups such as Team 190.

From the results of this WPI survey, it is recommended that the RICC keep its two-day November timeframe for the time being. However, we suggest that the steering committee consider a possible move into the spring to accommodate more projects that would not have to work through the summer to attempt to complete the requirements for the competition. While in theory this is something that could be done prior to the completion of the academic year, if the RICC were to once again release contest specifications in January, it could become problematic for those who cannot work on their entry during the summer. To attempt to alleviate this problem, the RICC steering committee should release the contest specifications for the following year's RICC a couple weeks after this year's competition. Given the number of people who

were interested in creating an entry for the RICC as a club project or ISP, utilizing a spring date would allow more of the school year to be available for students to work on their robots.

As for the other aspects of the RICC, they should be kept the same and evaluated after this year's competition. With the exception of the LEGO Design & Build Contest, these aspects drew mostly positive or neutral responses, and were not heavily commented on when survey takers were given the chance to. As for the LEGO Contest, although it was rated fairly well with positive and neutral responses, it was negatively commented on in the third question, which had asked takers if there was anything that they would add to the RICC. As such, alternative community building and socializing activities should be created, in case the LEGO Contest is not received as well as it should. Some of the suggestions that was gleaned from the survey that could be used to evaluate these alternatives include creating something that is more college-level appropriate, and perhaps making use of the VEX parts that WPI currently owns.

5.2.2. Target Audience

Our "target audience" for the RICC in regards to this survey was the students who had responded "Interested" or "Strongly Interested" to the first question, which had asked: "How interested are you in a competition like this?" Although the levels of interest in the competition vary, these are the students here at WPI who would likely participate in the RICC. The size of this target audience is 104 students: 29 of which had responded that they were "Strongly Interested" in the competition, and 75 who had responded that they were "Interested". This total accounts for 52.5% of the students who had taken the survey. By looking at how the target audience responded to the various aspects of the RICC, we can better cater the RICC to this type of people, and use that information to attract other people who are interested in participating the competition.

The target audience was largely neutral in regards to the timeframe of the RICC, with 62.5% responding "Neutral" when asked about the November 2009 date. However, there were few negative opinions, with 7.7% responding as such, leaving 29.8% who answered positively. Concerning the competition's two-day format more had indicated that they like this aspect of the RICC, with 53.4% responding positively, as opposed to 36.9% who were neutral and 9.7% who didn't like this aspect. With this data, it is safe to conclude that a two-day competition held in November would be fine for the target audience. A possible move of the competition date to the spring, as previously discussed with the general responses, may or may not affect the target audience. However, there is that close to a third of the audience that responded that they liked or really liked the timing of the first RICC, so leaving the date as is for future iterations of the competition would not hurt.

The main issue in trying to move the RICC into the spring is that it would run concurrent with the FIRST competition. It is safe to assume that there are FIRST participants in the target audience, as there are responses that signify as such in the survey results, with students making references to the competition in comparison with the RICC. Given this, however, it is made clear that a number of these participants do not like the current science fair format of the RICC. There were responses that requested a concrete set of tasks that the robot had to perform and a way to attempt to balance the talent level of the teams involved. This leads to the notion that FIRST participants may not even want to compete in the RICC given the differences of what they are used to, as the RICC intends to go in a direction opposite of current robotics

competitions. With this in mind, moving the RICC to a spring date would not hurt as much as the people who dislike the RICC's format would not compete or have a limited representation if the RICC were to remain in the fall.

The target audience had no real problems with the aspects that dealt with the competition itself, with the aspects that concerned robot creation, the competition theme, and the cash prize. Unsurprisingly, there was no one in the target audience that dislike the robot creation aspect of the RICC, and only 6.8% were neutral about it. Students also liked the competition theme of creating robots that improved the quality of life, with 77.9% indicating as such. 83.7% of the target audience also responded positively in regards to the RICC's cash prize. These three aspects we can safely keep largely unchanged in the RICC for now and future iterations.

There were no objections from the target audience in regards to involvement from the robotics industry and other academic institutions in the RICC. Again there was no surprise that a large portion of the target audience would like having the involvement of the robotics industry, with 87.5% of the audience indicating that like or really like the fact that the industry would be represented in the RICC. Although not as expected, 84.3% of the target audience responded positively towards the involvement of other academic institutions. These are two of the main pillars of the community that the RICC is striving towards, and as such, the fact that students are willing to accept these two groups is important for the community to thrive. One of the methods to help build the interaction between these groups that had been planned for the RICC are industry-related talks that can be given. 69.2% of the target audience indicated that they liked the fact that these talks will be given, with only a few disagreeing. These aspects of the RICC have no real problems with the target audience and should be kept for future installments of the RICC.

The LEGO Design & Build Contest was the aspect of the RICC that received the most negative responses from the target audience, with 13.6% responding as such. The target audience comprised the majority of all survey takers who had said that they disliked or really disliked. The negative comments regarding the contest in the write-in portion of the survey came from the target audience. As mentioned before, alternative community building and socializing events should be created, and either used in place of or in conjunction with the LEGO Design & Build Contest. These events should be something that students would want to participate in, and should be both enriching and fun. The goal of the RICC, as a reminder, is to create a community, and as such that community needs to able to be in harmony.

Only 12.5% of the target audience responded that they would not participate in the RICC. 29.8% responded that he/she would participate in the RICC as a MQP, and 54.8% said that they would create an entry in the competition for extra credit. 75% of the target audience, however, said that they would participate in the RICC for fun. With so few of a number not wanting to participate in the RICC, the competition as it is right now should be sufficient enough for the target audience wanting to create an entry in the RICC. The surprising statistic is the amount of students who want to participate in the competition for fun as opposed to using it as a vehicle for credit as a MQP or ISP, going against what Professor Matthew Stein from Roger Williams University had stated before.

The RICC only needs to be tweaked for the target audience, instead of having a format overhaul. There are only two notable tweaks that can be made or worked upon for the first RICC: contemplate a move to the spring, and create alternatives for the LEGO Design & Build Contest. Other aspects, such as the two-day format of the RICC, the competition theme, and the involvement from the robotics industry and other academic institutions, are well liked. The

interest and the desire to participate in the RICC are there, but these are the only tweaks with regard to student interest that can be done. The crux to improving the RICC for the target audience and the general audience at large will depend on evaluations that need to be carried out following the end of the upcoming first RICC.

5.3. RICC Website Analysis

The creation of the RICC website marks the competition's major representation on the Internet and its gateway to international exposure. This lends the RICC the ability to reach out to multiple locations across the globe to try to pull people into the community it is trying to create. The website is also a place to centralize its advertising and marketing while being the place where anyone can look for information pertaining to the competition. Its usefulness as a resource will serve it well in trying to continue to push the limits of the competition in order to grow a community. That said, as with the competition itself, the RICC website should be improved as time goes on to further facilitate this community.

The initial community outreach peaked mainly in two areas during the October 1st to March 5th timeframe that we have data for: once during the Thanksgiving week where the RICC was unveiled at a conference and online via blog posts, and another on the week of February 5th when registration for the competition officially opened. For data as of February 8, 2009, there were at least 60 academic institutions that had registered hits on the RICC website. These institutions were from all across the United States, ranging from coast to coast. Universities in the eastern part of the country, such as the Massachusetts Institute of Technology, Carnegie Mellon University, and Tufts University, were well represented in this data. Also represented well were universities in the western half of the United States, with institutions such as Stanford University, the University of Texas at Austin, and Oregon State University populating the charts. There was one international school that registered a hit: the University of Toronto, based in Canada.

With this sort of interest base across the country, there are the grounds to grow. For the data ending on February 8th, there were 2,194 hits from non-WPI .edu domains. As a part of a total of 14,650 hits from all non-WPI domains as of March 5th, this is a good number based on the fact that the RICC brand is still relatively new, and will remain as such for the next one to two years. It will take at least that long for the RICC to reach the sort of brand recognition that it needs to create a community. However, that does not mean the website cannot take the appropriate steps to facilitate the eventual activity and traffic the site is sure to see if the competition were to grow.

The major addition that should be made to the website is the creation of a message board system that would allow communication between various participating parties. A place to start modeling after would be the Chief Delphi forums for FIRST participants. Should the competition and this form of communication grow, the message board can further become a place for even general robotics discussion unrelated to the RICC. Of course, this is a couple years in the future, assuming that the growth of the RICC becomes as intended.

Missing currently from the website is a way for a user to give feedback about it. While there exists a way to contact someone (in this case Professor Richard Beach) concerning questions about the RICC itself, there is no way to evaluate the website from a user standpoint. The ability to evaluate the RICC website falls to whoever can be contacted to provide feedback.

Since the website can continually be improved, and it would need to be to support the intended growth of the competition, ways to accept feedback about the website is important. This can be implemented either by something simple such as placing a link where viewers can click to email about the website or something complex such as providing a form that can be filled out.

5.4. Logistics Analysis

There were additional issues that arose during the course of the IQP concerning the RICC that did not apply to either the conducting or the results of the interviews, survey, and examining the RICC website. These two are issues are funding and accommodating participants and attendees from out of state. Securing and maintaining funding for the RICC or any other competition is key for keeping the competition in place for subsequent years, so that it can continue to grow and foster the community it intends to build. Also, the logistics of accommodating participants who travel long distances to attend the event need to be handled.

5.4.1. Funding

Currently, the RICC is funded entirely by a grant from the National Science Foundation (NSF). Given the finite nature of this funding, it is critical that this funding eventually be replaced by donations and corporate sponsorship. The current lack of sources of funding other than the NSF grant, although disconcerting, is not unexpected. However, the number of external funding sources must increase for the RICC to be a sustainable event. Two major reasons for this lack of funding are the current economic environment, which is not a controllable factor, and the fact that the reputation of the RICC has yet to be established, giving companies little incentive to contribute financially. For this first iteration of the RICC, obtaining external funding is not a critical issue due to the NSF funding, however it is essential that the first annual RICC be an event that companies will see as sustainable from year to year with the potential for growth. Having this potential for growth is essential to create incentive for companies to sponsor and associate with the RICC.

One of the primary metrics that companies will use in determining if the RICC is an event worth sponsoring is the number of participants in the RICC. It is therefore critical that the number of student teams and the number of conference registrants be maximized. This can be done by taking advantage of the existing robotics and engineering academic/professional communities such as the IEEE, and the personal and professional networks of those already involved in the RICC. Writing articles about the RICC for the official magazines of professional societies such as the IEEE will create awareness of the event in the engineering and academic community, a necessary step towards increasing the number of participants. Taking advantage of the personal and professional networks of those already involved in the RICC (specifically, members of the steering committee) will also go a long way towards improving participation in the RICC. Examples of utilizing these networks include:

- Professors on the RICC steering committee encouraging their peers (both at their own institution and others) to sponsor RICC-worthy senior capstone projects in their departments, as well as sponsoring these projects themselves.

- Industry representatives engaging their colleagues to participate in the RICC, either as presenters, advisors judges or steering committee members.
- Industry representatives engaging their companies to make material or financial contributions to the RICC
- Students on the RICC steering committee encouraging their peers to participate.

5.4.2. Accommodations for Out-of-State Participants

With potential participants as far away as Texas showing interest in the RICC via the competition's website, it is important that the RICC be prepared to provide out-of-state participants with information on food and lodging within the Worcester area. The Central Massachusetts Convention and Visitors Bureau is a state-run organization for promoting the Central Massachusetts region as a convention and meeting site and a tourist destination. This bureau will be able to provide hotel and restaurant information, as well as discount vouchers, to out of state participants. At this point, the Bureau has been notified of the RICC event and is waiting for a rough estimate of the size of event. They should be notified when the RICC has a good estimate of this number. The contact information for the Bureau is as follows:

Website: http://www.centralmass.org
Address: 30 Elm Street (2nd floor)
Worcester, MA 01609
Phone: 508-755-7400
E-mail: convention@worcester.org

The primary point of contact for the department is Kathy Ryan, Convention Sales and Group Tour Manager.

6. Conclusions

The focus question of the IQP asked "How does one execute a competition and conference so that it fosters a community that features strong involvement from both academia and industry?" By obtaining the expectations and desires of those currently involved with the RICC as well as prospective student participants, the project team was able to ascertain what steps still need to be taken to help ensure the development of an academic-industrial robotics community. These steps are in the form of small changes to be made to the RICC that are believed will have a large impact in community building. Furthermore, the motivation behind these steps, which are specific to the RICC, can be applied to community building around an event such as a competition and conference.

Other methods of student interaction should be developed. While the LEGO Design & Build Contest is acceptable for now, answers from the open-ended response of the survey suggested that the LEGO event was not appropriate for a collegiate-level event. An alternative activity that would promote student interaction would be a systems engineering exercise, in which a hypothetical customer would ask a hypothetical company to develop a robotic application. RICC participants would then be broken up into different development teams (i.e. a structural team, a computing team, an electrical systems team, a sensors team, etc.). These teams would then work together to develop system requirements for the hypothetical robot. This activity would require the students to interact within their team, as well as require teams to interact with each other and the hypothetical customer as they examine the tradeoffs that have to be made to meet the customer's requirements. Like the proposed LEGO design and build competition, this activity encourages student interaction, and has the added benefit of being applicable to the robotics industry.

With regards to competitions and conferences in general, posing a problem to the participants and asking them to find a solution, is an ideal way to get participants interacting. Actively encouraging interaction in this way is far more effective in community building than simply gathering participants at the same event and hoping that meaningful interaction takes place. Posing a problem to the participants of an event such as the RICC and asking them to solve it as a group not only guarantees meaningful interaction, but can also serve as a real world exercise that is applicable to an academic-industrial community

There needs to be an effective plan for evaluating the strengths and weaknesses of the RICC. This requires that data and feedback from all participants, including the organizers of the RICC, be gathered in November. It will then be critical to look at this data and analyze the effectiveness of every aspect of the event. Like any untested event, the RICC will not run perfectly the first time it occurs, and several aspects of the event may turn out to be ineffective at achieving what they were intended to. It will be essential to the growth of the RICC to identify and learn from mistakes and problems that occur during the event. Likewise, it is important to identify what goes well during the event, and maintain or improve upon those aspects. A new IQP, which devises methods to determine the level of success of various aspects of the RICC, carries out those methods during the event, and then analyzes the results, would be a very effective way to evaluate the RICC.

Regarding the future of the RICC, as the tournament becomes sustainable annually through financial support from the robotics industry rather than temporary NSF funding, a rotating host system should be implemented. For this to be accomplished a permanent board of directors must be established. Furthermore, the RICC will need to be restructured as an incorporated as a 501(c) (3) non-profit organization, rather than an internal WPI committee. Implementing a rotating host system and incorporating the RICC as its own organization rather than a WPI event is essential to fully realizing the mission of building a community that involves many academic participants, not just members of the WPI community.

Although the rotating host system is something rather specific to the RICC, the reasons for implementing it are relevant to any competition or conference aimed at building a community. There was a concern that having the RICC hosted solely by WPI was that a sense of ownership of the community among other academic institutions would be discouraged. There was the potential for other schools to only see themselves as 'guests' of the RICC rather than members of the community. When building any community, it is essential that the members of that community feel as though they are contributing members. And in the case of the RICC, implementing a rotating-host system is an effective way of doing this.

It is essential that potential corporate sponsors view the RICC as a 'success', which primarily requires high levels of participation from multiple colleges and universities. In its early stages, it can be expected that the RICC will have difficulty attracting participants due to the relatively unknown nature of the event. It is therefore critical that the small community that already exists, particularly the members of the RICC steering committee, use their existing personal and professional networks to promote the tournament. It is not enough to simply announce the RICC to the academic community, and hope for participants. Until the RICC develops a solid reputation, it will require that those already involved actively solicit others to participate in the event. It should be kept in mind that the conference portion of the RICC should be advertised as its own event as well as part of the larger RICC. It would be a shame to have reduced conference attendance because potential attendees did not want to participate in the competition.

When trying to build a community around a specific event, with the goal that the event attracts itself attracts more members to the community, it is important to keep in mind that until the event develops a positive reputation in the larger community (the engineering community in the case of the RICC), it will not draw in many people. This is why it is essential that in the early stages of such a community, the existing members of the community must actively bring in more people. As the event the community is centered around grows in size, it will also grow in reputation, and will become more effective at drawing in more community members.

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Appendices

Appendix A: Faculty Interview Transcripts

Fred Martin
University of Massachusetts Lowell
Associate Professor, Department of Computer Science
Conducted by Samuel Kaplan

Samuel Kaplan: Alright, so how did you hear about the RICC?

Fred Martin: Through Mike Gennert; I was making a visit here for some other reason, you know what? I was making a social visit and he was telling me about this and also UMass Lowell has a grant under the same NSF funding program that funds the RICC so I thing we were talking about that.

SK: And what got you interested in participating in the RICC?

FM: Okay so I've been doing robotics education contests since I was a doctoral student in the 80's and early 90's so I'm involved in creating robot contests and then bringing my students when I became faculty to contests so it's something that I've been involved in for a long time.

SK: Is that what ultimately led you to participate in the RICC or was there anything else that got you interested in it?

FM: Well, so Mike specifically asked me to be on the board, and then when I learned of the mission which is to encourage innovation in creating robotics… I mean I think the basic idea of creating robots that are useful to people beyond a typical robot contest is a cool idea, so that appealed to me.

SK: And how much student involvement in robotics, both academic and extracurricular is there in robotics at your institution?

FM: Okay so it's primarily academic; our students, within the curricular domain, myself and my colleague Colleen Enkle run a series of robotics courses at the undergraduate and graduate levels

SK: And how much academic interaction do you and your colleagues have with other engineering schools?

FM: So we have a school of engineering at my university, I'm in the school of sciences. And we do have students from the school of engineering in our robotics classes. I think that

that's the primary interaction that I have with schools of engineering within my own university.

SK: How about with other engineering schools, like WPI or RPI or any other schools that you may have academic interaction with?

FM: Yeah so I guess because I'm in the Department of Computer Science, I tend to have a professional relationship with other computer scientists. Those typically are not in engineering schools I don't know if you intend to have that narrow, like it must be engineering. Actually, what's an interesting point is when a lot of prospective students come to visit my department, you know, here we are, computer science department. We also have at my university a department of electrical and computer engineering and there's no way to explain to a high school student what is the difference between computer science and computer engineering. But what I do find is that students are surprised to find robots in the computer science department so to me it's very important that computer science should be viewed in such a way so people realize that we do hardware.

SK: So what's caused this interaction we've been discussing to be either successful or unsuccessful?

FM: Right, so what I said last time was that the curricular structure has to be in place where engineering students can get credit for the computer science course that I teach. And then the ideas in the class have to be accessible, so I've used a programming language called Labview which is very accessible to non-programmers… so that's one component.

SK: What do you think the RICC can do to create and strengthen an academic relationship between the different robotics programs from each participating campus?

FM: Right so what I said last time was having an event structure the way it is where students from the different universities and colleges that will come here, that students have a chance to interact with each other, I think that's important. Also, so faculty can interact with each other and you know maybe find common interest and think about ways to collaborate so I think having a socially open event would be a big aspect of that.

SK: Now, what are you hoping involvement in the RICC would provide to your robotics program at UMass Lowell?

FM: To give my students a chance to make cool, useful robots. I think that would be different than what I've been doing so far. To give a chance to connect to industry, I think that would be good. That's always a good thing, and to meet other students doing interesting stuff.

SK: Now, what's your school's vision for the future of your robotics program?

FM: Yeah we want to increase, both myself and my colleague, Colleen Enkle, are doing outreach and I do research work in K-12, and I think we definitely want to have a bigger footprint in the regional school districts that are near to us so that students who are going through particularly middle and high school when they start to think about what do they want to do that they think about coming to us.

FM: I think that it's important that while this event is hosted at WPI, I mean obviously WPI wants to take credit for innovating and creating this but at the same time we were talking about should WPI be on the logo—my clear answer to that would be no. It should somehow be branded as something that's bigger than WPI, I mean imagine one day, this thing could be rotating hosts. You know the RICC is just a big event that people take turns hosting; it's not solely a regional WPI thing. Now certainly at the beginning it is, you guys have home field advantage, but the big success of this is that it becomes some big event that moves around the world

Also suggested by Professor Martin when the microphone was off: the companies that are involved should be showcasing some of their emerging technology as well during the first day of the RICC.

William R. Michalson
Worcester Polytechnic Institute
Professor, Department of Electrical & Computer Engineering
Conducted by Samuel Kaplan

Samuel Kaplan: How did you hear about the RICC?

William Michalson: I first heard about the RICC at the robotics faculty meetings at WPI.

SK: What got you interested in the RICC?

WM: The fact that I'm part of the robotics faculty and they needed manpower.

SK: How much academic interaction do you and your colleagues have with other engineering schools?

WM: I would say a fair amount. I probably communicate with colleagues at other schools on a weekly-ish basis

SK: Could you elaborate on some of that interaction?

WM: The interactions take on a variety of forms. From reviewing ideas for proposals, interacting with students that have been directed to me from other universities, being parts of thesis committees, things of that nature.

SK: Can you identify anything that has caused that interaction to be either successful or unsuccessful?

WM: That's actually kind of a hard question to answer. I mean, I consider the interactions to be, in aggregate, successful, because usually they'll end up in people either getting their theses completed or they'll end up in proposals being written and hopefully funded, or they'll result in other collaborations. It's hard to measure a lack of success because you never know if an idea you gave somebody to check out actually panned out. You don't always close the loop so it's hard to know.

SK: Do any of your students, robotics or otherwise, have any interaction with other engineering schools?

WM: Typically at least at the graduate level, yes. You'll attend conferences, you'll find people that are working in similar areas, you'll start to communicate with them. Some of them may be in industry, some of them may be in other schools. At the undergraduate level I personally see less of that. I see more of that at the graduate level.

SK: What do you think can be done with the RICC to create and strengthen a relationship between the different robotics programs at each participating campus?

WM: In terms of the RICC, I'm primarily involved in the steering committee, so in that context I'm certainly interacting with representatives of other schools and trying to accommodate their ideas and their needs. The other things that I'm doing particularly within the context of the RICC is I'm involved with trying to get academic and professional organizations as sponsors. I'm communicating with representatives from the computer society, from IEEE, I will be contacting people from the robotics and automation society, trying to contact people in AIAA and other organizations which have a tremendous overlap in to the educational community.

SK: What are you hoping that involvement in the RICC will provide to WPI's robotics program?

WM: I'm hoping that it will provide a focal point. I'm hoping that it will aid in WPI getting recognized as a player in the robotics community.

SK: What do you think the RICC can do to foster the relationship between the academic community and industry?

WM: Outreach. I think that things like the RICC provide us a good context to invite both academic and non-academic institutions to come in and sit at the same table. I think that in a sense it's a networking opportunity that hopefully will help everybody involved.

SK: What's your vision for the future of the robotics program at WPI?

WM: Well, right now it's a program that is sponsored by the NSF. The money for that will run out at the end of one or two years. So I think the biggest challenge we have is to find a source of funding that will allow us to sustain the program. We're actively pursuing that, we don't have that yet. But I think the biggest challenge that will determine the longevity of the program is being able to find the source of funds necessary to run it.

SK: Is there anything else you'd like to add or comment on about the RICC or WPI's robotics program in general?

WM: I guess my head is so buried in trying to create it that I haven't really thought about that. I wouldn't mind having 40 hour days so I could complete some of the hardware designs that we're going to be using in the up and coming 3000-level robotics courses. But I think we're making some great progress in developing the undergraduate program, in developing some 3 and 4000 level courses now and developing a graduate program in robotics. It's a train that's left the station that's rolling down hill.
I think the biggest challenge for faculty and students is keeping up with it and not getting run over by it. I have a healthy respect for the amount of panic that is going to be necessary to pull this off. It's very new and it's very exciting and everybody involved with it in one way or another is a guinea pig. The students, the faculty, the administration, we will all do great things that will make people happy. We will all do awful things that will make people miserable. Hopefully we will do more right than

wrong and even more importantly I hope that everyone maintains a sense of humor for the first couple years, because we're going to make serious mistakes, we'll have wonderful successes. I think on average our velocity vector is pointed in the right direction, that's not to say it's completely stable. But I think that the faculty have a tremendous amount of investment in making the robotics program successful. I think the students are very enthusiastic. So far we're working them like crazy and they're whining less than average, I think it's a great bunch of kids, I think it's a great bunch of faculty. If we can maintain the path we're on this is going to steamroll over the entire university.

Taskin Padir
Worcester Polytechnic Institute
Visiting Assistant Professor, Department of Electrical & Computer Engineering
Visiting Assistant Professor, Department of Robotics Engineering
Conducted by Samuel Kaplan

Samuel Kaplan: How did you hear about the RICC?

Taskin Padir: I'm part of WPI and I'm part of the robotics faculty at WPI and this is being put together by WPI so that was a natural communication to me.

SK: How much academic interaction do you and your colleagues have with other engineering schools?

TP: Well, I just came to WPI from another institution, Lake Superior State University in Michigan and I still have quite close relationships with my colleagues at that university. We didn't have a robotics engineering program but robotics was an option in three major engineering programs bake at Lake State: Electrical, Computer and Mechanical Engineering, so I try to keep in touch with them and interact with them on projects and exchange Ideas.

SK: Could you elaborate maybe on some of those projects that you've been working on?

TP: Well, as I said I'm very new to WPI so naturally I have a lot of previous work that we did already at Lake State. But, when I left Lake State, we also made a commitment with a couple of my friends, or colleagues, in the sense that we should further those studies. So, for example, I am a fan of project-based learning in engineering and, with one of my colleagues, we just presented a paper that involves student projects and we're hoping to continue that collaboration from a distance and see how it goes

SK: Now did any of your students at Lake State have any academic interaction with other engineering schools?

TP: Yes they did. It was a very small engineering school so it gave us the opportunity to interact with our students very well and to direct their energy to competitions and things like that. I know that IEEE and ASME student branches attended a few competitions nationwide. ASME was active, SAE was active at the mini-Baja so they interacted with a lot of universities, mostly Midwest universities and engineering schools.

SK: Was that interaction successful or unsuccessful and what do you think was the cause of that success or lack thereof?

TP: I think that for the most part it was very successful because our students learned from that interaction, and other schools learned from what we do at Lake State. And I'm hoping

that I can bring that to WPI too, and I know that at WPI there is that interaction and I hope that I can be a part of it.

SK: What do you think can be done with the RICC to create and strengthen the academic relationship between the different robotics programs from each participating campus?

TP: I think it will be a natural platform for different engineering schools to collaborate and in a sense show off what they're doing with their programs because it's specifically geared towards undergraduate and graduate students and their projects, and we know that individual engineering schools are working on those projects so the RICC will provide that one common platform over a couple of days to exchange ideas, to showcase what each individual school is doing and it will be a natural platform for that.

SK: What do you think the RICC will bring to the robotics program at WPI?

TP: Well, first of all, I think it will bring recognition of WPI's brand new Robotics Engineering program you know other universities, other engineering schools will learn about our program and what we do here, and more importantly we will learn from what they are doing in other programs.

SK: What do you think the RICC can do to foster the relationship between the academic community and industry?

TP: I know there will be participation in the RICC since I'm part of the planning committee. And I'm sure that we can narrow the gap between where industry is heading and where academia is heading in the field of robotics and as you know robotics is emerging really fast and there are a lot of problems that an individual can look at. So maybe RICC can be used as a platform to merge on ideas and to improve on collaboration. And more importantly, it is always valuable for industry to know what academia is doing and for academia to know what industry's needs are. So that we can improve in sciences and engineering and in this context, the field of robotics.

SK: What is your vision for the future of the robotics program either at WPI or Lake State?

TP: Well now that I'm part of WPI I think I'll speak more on behalf of WPI. This is a very exciting program. It's a brand new program, a unique program, so I really hope that we can educate young individuals, like yourself, to be successful robotics engineers when they graduate, and if we can play that role I think that will be a big achievement. So, I think WPI can play a key role in robotics engineering education as we are doing right now.

SK: Do you have any other thoughts you'd like to share about the RICC or the robotics program here?

TP: Just to wrap up what I've been saying, I think that both the RICC as an event and WPI's new robotics engineering program are very exciting opportunities, and I know that

faculty and colleagues are working very hard to make both the RICC to make both the RICC and the program a success with the help from our students, with the feedback from our students, with the feedback from industry (industrial advisory boards and so on), And it’s just a great opportunity for everyone who’s involved

Matthew Stein
Roger Williams University
Assistant Professor – Engineering, School of Engineering, Computing & Construction Management
Conducted by Andrew Yee

Andrew Yee: How did you first hear about the RICC?

Matthew Stein: Richard came down for a conference at Brown and I went up there to give a presentation, so we met there in the lobby and I teach an undergraduate institution so we talked about undergraduate. That's how I found out.

AY: What about the competition got you interested in and what ultimately led you to be part of the steering committee?

MS: I'm interested primarily in undergraduate, so for us, we have seniors that spend a year doing something and that could be concrete canoe, that could be still bridge, that could be human-powered vehicle, so we've been wanting for a long time, so maybe do a robot competition but it has to have the right parameters, and so, I've been looking for a vehicle that a senior project could contribute to and when they said "We were talking about this one", I said "Sure I'll talk with you", so I'm in the business of senior projects.

AY: One of the goals of the RICC and one of the major goals of our project that we're currently doing is to create a community between both academia and people from industry. So we're trying to get people to interact with one another between different schools, industry, and have that back and forth. So, to that end, what kinds of interaction you have either with yourself and your colleagues with other institutions and your students?

MS: Our students respond to most acutely to senior projects or classroom projects that are real. So, if there is an abstract project that we think up, they'll do it because they have to, they get a grade. But if it's something that we can say "This industry is looking at this particular problem", then they'll be more interested in it, and they see it as more potential and so if you can have a real project that okay, here is a industry that is looking for a better way to sorting its toilet paper rolls, produces toilet paper but want to sorts its rolls, and they'll be like "Oh oh okay we'll do that". That's the kind of interaction we look for: real world problems and sponsors. Not really money, because we can't really sell student work to companies. Not as intellectual property, but student work is student work. It rarely makes the grade it's rarely a profoundly new idea that some of the graduate students will come up with but it is a does get their interest.

AY: Do they interact with students from other schools?

MS: It's amazing, not at all.

AY: Not at all?

MS: Yeah, you put them in the same room and they just ignore each other completely. And, unless they see something immediately in their benefit to learning from other students it is more often rivalry. It is more often that a "Well why do I need to see those UMass guys"?

AY: Kind of like a school pride kind of things?

MS: No it's just they don't see any reason. Like, they see that there might be a job for industry interaction and there's grades associated with and prize money associated with contest sponsors. If it's not clear whether a Roger Williams student is going to get from a UMass Lowell student other than someone to go drinking with. So there's no context where it is important for them to work together.

AY: What kind of things do you think the RICC could do to actually get them to work together or talk?

MS: What for?

AY: Either for the purposes of getting to know each other.

MS: They know each other on Facebook. Where's the academic value in that?

AY: At least maybe to discuss about robotics.

MS: I mean, they can yak. What we absolutely shove down our students was a whole bunch of academic content. Now, they work with each other in groups all the time, but what academic content are you going to get?

I actually have a true story about this, where I had a robotics project where my students had to build a mechanical end-efector and students at the University of Wisconsin La Crosse had to program it. So they had to operate over the internet, and so I had the relationship with the faculty at the University of Wisconsin and I was in Pennsylvania—multiple states between us, thousands of miles, and there was this project where they had to work together. And so, the La Crosse people had to work, which means they had to negotiate what does the mechanical aspect of it versus what the software aspect—sounds like a good robotics project and they thought it was interesting, but they could never get over a couple of things: they could never get over that their grade depended on something out of their control. "My grade depends on somebody from Wisconsin"—they couldn't stand that. They just: "Wait, we're not in control of them. We can't do anything. We can't even stand inside their dorm room. So, we're just at the mercy of whether or not this guy shows." So they could never get around the grading thing—my grade depends on it. And here they were supposed to like it, and in fact they despised it because it was a graded activity, and if it wasn't a graded activity, and just voluntary, then they had nothing to say. The only thing was that they had sort of fun making fun of their

professors and started to just chat with each other. You think it was this was this thing that they could really collaborate and discuss but if it wasn't graded it was not important to them and if it was graded then it made them very, very upset that their grading would be reliant on somebody else.

AY: So do you think there would be anything that could be done to get them more interested in doing something voluntary without the grading part?

MS: No, because they're busy enough you're a student yourself. And you know, how much extra time do you have to do semi-academic stuff that is not graded? You got plenty of time to play ultimate Frisbee, or you know you got all the time to do gaming and other sorts of things but how much time are you willing to throw at an academic subject not for credit?

AY: What are you hoping that the RICC would do to robotics over at Roger Williams?

MS: You know, I am all for it. I am supportive of it because of "A senior project has to be a capstone design." So a table game doesn't work. Like robo-soccer. Robo-soccer doesn't work as a senior design because it is just this little mechanical gee-wilikers, it doesn't have enough importance, it's not broad enough, it's not capstone. So, wide-open kind of robot to improve the quality of life works as a senior capstone project. Now you still need a motivation. Motivation is okay, we're going to go to this competition, it's got a deadline, it's got a report, it's got a judging so that works as an academic exercise and a wide-open competition works a lot better than a table game or some sort of robo-soccer which has no broad implication. So, sure, this could be a great vehicle for a group of seniors from my college to participate in not really to win, but to get credit for their six credit design sequence and to do something that they're proud of.

AY: As a follow up, what do you think the RICC could do to have your students interact more with industry, get them more involved with the industry aspect?

MS: My students are certainly willing and if they would love an invitation to a company to come in and look at what Foster-Miller does and the robotics area. But, it has to be something relevant to what they're working on. If not, it's just a plant tour, and you can get a couple kids to come to a plant tour, but if it's just "Come on, we're going to go look" then it is a volunteer thing, people come when they're ready. But if it's something where this is your project, you're going to work in this industry, on biorobotics or medical robotics and this is a company that does that, let's go look at their lab, then they have a direct interest.

AY: And, finally, do you have any other thoughts?

MS: The collaborations have to be goal-directed otherwise it's just social space, and you have got plenty of social space.

Grétar Tryggvason
Worcester Polytechnic Institute
Department Head, Department of Mechanical Engineering
Conducted by Samuel Kaplan

Samuel Kaplan: How did you hear about the RICC?

Grétar Tryggvason: The program came up in our weekly meetings in the robotics program and I believe we conceived the idea of writing the proposal at those meetings. I was in there very much from the beginning.

SK: What got you interested in the idea of creating the RICC?

GT: Well, one of the purposes of the robotics program is not just to generate 'kootchie' things, it's really to help the industry grow and in order to do that, you really have to do more than just compete or build robots that navigate and things like that, you really need to conceive new products that come out of robotics that really build on the integration of sensors, actuators and computers and the RICC is sort of an effort to help that foster such an environment.

SK: How much interaction do you and your colleagues have with other engineering schools?

GT: Well, all of us have lots of interactions with other engineering schools through various means. The specific ones to robotics, those are mostly with the faculty whose research activities fall into robotics. Mike Gennert has had lots of interactions and I believe some of my other colleagues have had interactions through their research activities. But all of us have lots of interactions, as I said, at various levels.

SK: And what causes those interactions to be either successful or unsuccessful?

GT: Well I mean they can be successful in many ways, in sort of general I would say interactions that lead to proposals and funded research, that's certainly one measure of success, sometimes collaboration results in articles. Sometimes on the teaching level there's an exchange of materials, sometimes students interact. So there are many ways that can be successful. I would say since the robotics program per se is the only robotics program here, the success of those specific interactions will be when other schools start to establish their programs, and there is some indication that that will happen.

SK: What do you think can be done with the RICC to create and strengthen an academic relationship between the different robotics programs from each participating campus?

GT: Well as I said, at the undergraduate level this is the only robotics-specific degree, but of course there are other robotics activities, and what we are hoping is that the RICC sort of brings students from these various campuses at least here in the neighborhood and sort of

help them form some community spirit if you will where they showcase each other's projects.

SK: What are you hoping that involvement in the RICC will bring to WPI's robotics program?

GT: Well, we have seen that as we promote the program, that generates interest in it. As you probably know we've had a reasonably solid presence at the FIRST competitions and I think that there's no question that we are getting students through that exposure so I think the RICC will bring an additional exposure and help us increase the prominence of the program.

SK: What do you think the RICC can do to foster the relationship between the academic community and industry?

GT: The robotics program already has significant visibility in the robotics industry in New England but I think this will strengthen that relationship. Obviously the RICC should be a forum where companies can sort of look at students who are competing and evaluate their talents and see if they want to hire them or recruit them. I think we may also see something come out of the competition which somebody may want to commercialize or build on. So, I think it's yet another forum which we can use to foster interactions.

SK: What's your vision for the future of the robotics program here?

GT: Well in terms of undergraduate students, it's already the fourth largest major on campus, or at least was last year, and there's every indication that that number is not going to go down so the robotics program is probably going to be the next sort of successful engineering program. In the history of engineering there have been programs that have grown out of a need. Many of course have not gone anywhere, but for example Aerospace Engineering certainly filled the need where there was a demand for engineers. Computer Science was another program that was established because there was an industry need for that and I think robotics may very well be the next big engineering discipline for the next few decades. What happens then? Maybe there's something else that comes along.

James Van de Ven
Worcester Polytechnic Institute
Assistant Professor, Department of Mechanical Engineering
Conducted by Samuel Kaplan

Samuel Kaplan: How did you hear about the RICC?

James Van de Ven: I heard about it through the steering committee and was invited to be a part of the steering committee so it was kind of when things were forming when I heard about it.

SK: And what got you interested in the RICC?

JV: I think that robotics is something that gets students excited and you see a lot of the competition going on at the high school level with FIRST robotics but there doesn't seem to be quite as many competitions that are across schools in the collegiate level. I think this is a great opportunity to get students excited outside of the classroom

SK: What ultimately led you to participate in the RICC at WPI?

JV: Just a personal interest in the project and wanting to be involved with trying to improve the program.

SK: How much academic interaction do you and your colleagues have with other engineering schools?

JV: You know we would like to have more but quite honestly it's fairly limited at least to my position, where just keeping up what's going on here on campus is more than enough and you know we'd like to extend beyond that and hopefully this will give us a chance to do more of that. So outside of conferences and whatnot you know there's not a whole lot of interaction so I think that this might be a good vehicle to do that.

SK: Do any of your students have any academic interaction with other engineering schools?

JV: I think in general, no. I think most of the engineering students are, you know, focused on what's going on at WPI's campus and not seeing much beyond that. I think this program is good for that as well

SK: What do you think can be done with the RICC to create and strengthen an academic interaction between the different robotics programs from each participating campus?

JV: The things I would think would most foster this kind of interaction and improve the collaboration is just making sure as many other schools get to know about this as possible. And send teams to this. So trying to market this program and trying to get it

out there as something that's hot in New England and trying to foster these cross-school discussions.

SK: What are you hoping that involvement in the RICC will provide to the robotics program at WPI?

JV: The biggest thing is that I hope it shows or emulates that we are the place for robotics right now. T hat we have the first undergraduate robotics engineering program and taking that to the next level of let's have our competitions and conferences here, let's let the world know that this is the epicenter of robotics education.

SK: What do you think the RICC can do to foster the relationship between the academic community and industry?

JV: I think that the RICC, by inviting industry to participate both on the steering committee and as sponsors for the event and as judges for the event can allow industry to see what's going on with engineering education and let them see the students and hopefully develop some internship type of opportunities and eventually see these students as potential future hires. So, I think that that's where industry is excited about this project.

SK: What's your vision for the future of WPI's robotics program?

JV: I see us right now as just emerging from the concept, getting this program going. I see the RBE program pushing ahead to the point where we become the leader and other schools start developing Robotics Engineering programs and start modeling us. So I can see textbooks coming out of this school. I can see other learning tools from lab setups to everything else that other schools will emulate. So I think that we need to stay ahead and provide the model for other schools to follow.

SK: Do you have anything else you would like to add about the robotics program or the RICC?

JV: Something that you might want to think about and give some more thought to is the interaction between the conference piece of it and the competition piece of it and how do those two interact? It's the Robotics Innovations Competition and Conference, so which one is more important and which one builds the community better is it a competition that builds community or is it a conference that builds community and how do you balance those two?

Appendix B – Industry Interview Transcripts

Paul Brown
Hewlett-Packard
Conducted by Samuel Kaplan

Samuel Kaplan: How did your company become aware of the RICC?

Paul Brown: I'm a WPI grad and I happened to be at an event to celebrate the part-time MBA program being the first in the nation and I was speaking to a woman by the name of Gina Betti, and we started chatting and I had talked to Gina at different events from the Management Department and she came and asked me if I would be interested in serving on the RICC committee and it was actually interesting to me because back in 1981, I came back to WPI and got an MBA and Doctorate. [Somebody] was trying to recruit me to have a lead role in a robotics lab that they had down in the basement of Higgins. It turns out I couldn't come at the time I had to come six months later. That's how I became interested.

SK: Is your company a sponsor of or otherwise involved in other collegiate academic events such as the RICC?

PB: That I can't say for sure, but HP has a strong interest in college life and engaging with creative college students to bring into our business. One of the involvements that I do have with college students is we do have a very strong internship program. In my particular business we recruited two interns to work over the summer. We did something pretty innovative which was we had them stay on part time from after September. What's innovative is they're working from the West coast. They're doing software development and we work it out and we think it's pretty innovative.

SK: What's your company's intended involvement in the RICC from a personnel standpoint? I know you're involved in the steering committee.

PB: I intend to be involved in the steering committee and I expect to serve on the day of the event. Because of some unique situations that I shared with you earlier I haven't been able to go to the last two meetings, I can't really say what my company's involvement will be but I intend to participate as a volunteer. I don't know what HP's intended financial involvement will be.

SK: What does HP expect to gain by being involved in the RICC?

PB: I particularly like the mission of the RICC to do something practical with robotics. I've had occasion to go to a FIRST competition and I think that putting a ring on a peg for a high school student is a great thing, but one of the things I know about WPI is that the IQP, the intention there is to do something with technology to change society and I'm

hoping that we can influence other college teams to choose to do something with robotics that changes lives.

SK: Does your company place higher priority on name recognition by being associated with this event, ideas for new innovations, or interactions with student teams?

PB: I would guess that our company would hold the first two at about the same level: name recognition and innovation. One of the slogans, you might call it the motto of HP, is 'invent', and so anytime there's a place for us to participate in innovation, to influence innovation, to understand where young inventors are going… old inventors, is something we'd be interested. The student teams we're always looking for smart young technologists and people from across the business, we're looking for smart finance people, smart physicists and so on. We're looking for people that are both smart and capable.

SK: Do you have any goals for the RICC that you would like to see met in order for you or your company to participate in this event annually?

PB: I've never been involved in an actual student event like this, and so it's very interesting. I've been listening right along and it seems like the goals are a little bit modest in that across the Northeast that we might only find twelve student teams that might be interested in doing this. What I've been struggling is that we have an enormous interest in high schools for the FIRST competition, and when we get to the college level we can only find twelve technical teams, that's the rough estimate, that will want to put a project together. I'll be very interested to see when the marketing goes out and when the original announcement goes out to see what kind of interest there is and my hope is to have not twelve, but twenty-four.

SK: How do you see interaction between your company and the RICC student teams playing out?

PB: One of the things I'll be alert to is the innovators that I see in student teams. I love to find that engineer or technologist that's really going to bring something innovative to HP. I intend to be a support to the student teams. I'm not completely sure how HP will be involved because I need to get back on track with the committee and then connect with people in our community relations area.

SK: What do you think the RICC can do to foster a relationship between your company and your industry and the academic community?

PB: I think that HP is always interested in new ways to use IT technology to see how laptops or RFD or any of the robotics technology might interact with an HP system. We want to be on manufacturing floors where robots are and we want to be part of the controllers for robotics and we want to be perceived as the IT company of choice if they need some technology to control, to capture information we want to be perceived as the company to go and do that.

SK: Is there anything else you would like to add?

PB: Like I said, I think it's a very interesting competition. I was very intrigued at one of the discussions where we intended to do something that was innovative, that would impact society. I think that we'll be pleasantly surprised that we'll have more than 12 teams involved. For WPI I'm very pleased to see WPI in a lead role in something like this. My son recently graduated from WPI and in the last 4 years he was here I did a lot of reading on the website on activities going on and I think this is a very different thing for WPI to be involved in at the college level and I'm very pleased to see that it's happening and happy to do what I can to help.

Charles Dean
Foster-Miller
Conducted by Andrew Yee

Andrew Yee: How did your company first become aware of the RICC?

Charles Dean: WPI approached Foster-Miller for an advisory position on the board of the robotics program, so as a member of the advisory panel, we were automatically selected for involvement in RICC planning.

AY: Does your company sponsor other collegiate academic events similar to such as the RICC?

CD: We do sponsor one other competition to my knowledge, which is the MIT Soldier design competition that is held every fall/winter in Cambridge.

AY: What is your company's intended involvement in the RICC?

CD: Well first of all it is important to us to help educate the young adults who are in the Boston/Worcester/Northeast area of the United States in the fields that lead to great engineering/ areas that we work in. Robotics is just one of the many areas Foster Miller is engaged in. The robotics field we're looking forward to seeing young engineers develop who can help the industry and help Foster Miller in the areas of software, electrical engineering, mechanical engineering, systems engineering and computer science engineering, and in the long run we would like to be able to higher some of these young talented students.

AY: What does your company expect to gain by being involved in the RICC?

CD: We want to be involved in the community of educators who are helping to promote higher education, higher learning and in this case in the field of robotics. It's basically our pride in helping to bring up the next generation of engineers.

AY: Does your company place higher priority on, name recognition by being associated with this event, ideas for new innovations, or interaction with student teams?

CD: So at this point the RICC is in its infancy this is the first year, so name recognition probably doesn't count at this point. It'll take several years for the name RICC to get known throughout the Northeast and throughout the United States. So our biggest pride is just being involved, you know helping out.

AY: Do you have any goals for the RICC you would like to see met in order for your company to participate in this event annually?

CD: I wouldn't say we have goals that would have to be met in order for us to stay involved. We want to be involved with the department, and part of that is being involved with the competition. We would like to see the competition to get more focused over time, because each year it'll get better, as it should get, and so we're interested in seeing it improve. It's going to be a great competition the first year, but everything improves with time and experience and we would like to watch that take place, and perhaps the challenge of the events to get harder over time, as we get comfortable with what's the appropriate robotics competition for the college level.

AY: How do you foresee interaction between your company and RICC student teams playing out?

CD: I see that the there's a good chance that we may have advisors from our company to help with student teams. Certainly not all student teams but with some student teams so that the teams can benefit from having someone in the industry of robotics give them advice, give them support, give them perhaps ideas, while not designing the solution for the student teams, allowing the student teams to do that on their own.

AY: What do you think the RICC can do to foster the relationship between your industry (and your company) and the academic community?

CD: Certainly the RICC and the computer science and robotics programs at WPI serve as a conduit between the industry, and Foster Miller and academia. It would be a good example of that type of communications and teaming that we can take forward with other universities between WPI and other universities and industry like Foster Miller and other companies so you set up a whole network of people talking, competing, growing that perhaps doesn't exist to that extent today.

AY: Is there anything else that you would like to add? Just any other thoughts or concerns.

CD: No concerns, just excitement over what the RICC can become and how each year perhaps the RICC might look at a different challenge areas to help different sectors of our community, so whether it is healthcare one year, or other types of robotics another year, it'll just be exciting to watch it grow.

Dave Matheson
iRobot
Conducted by Samuel Kaplan

Samuel Kaplan: How did your company first become aware of the RICC?

Dave Matheson: Probably through iRobot's chairman, Helen Greiner, who is on the advisory committee on the robotics program here at WPI. So an invitation was extended to me in my role at iRobot which is Create program manager.

SK: Is your company a sponsor of, or otherwise involved in other collegiate academic events such as the RICC?

DM: Nothing quite like RICC, we have liaisons at other schools but nothing as formal as our involvement on the steering committee.

SK: What is your company's intended involvement from a personnel standpoint as far as judges for the RICC, people who may give talks for the conference portion of the event? Obviously, you're on the steering committee.

DM: Right now, I'm the one representative and I'm here because we are very committed to robotics and want to do everything we can to help. Many of our employees have been involved in the FIRST competition, so we have experience with robotics competitions we wanted to bring that with us as you formulate plans for your competitions and I think at the collegiate level there aren't a lot of competitions so it's encouraging that this is being done.

SK: Does your company intend to sponsor the program either directly through monetary means or by providing equipment for students to use?

DM: At the moment, we have no plans to do that.

SK: What does your company expect to gain by being involved in the RICC?

DM: I don't think we're looking to gain anything but we're looking to provide as much support and encouragement and inspiration as we can to the whole team.

SK: Does your company place a higher priority on name recognition by being associated with this event, ideas for new innovations, or interaction with student teams?

DM: I think we would be more interested in interacting with the student teams. Not to say the name recognition isn't important as part of our branding initiative but that's not our primary focus right now.

SK: Do you have goals for the RICC that you would like to see met in order for your company to participate in this event annually?

DM: I think to the extent that the committee and the competition promote the whole notion of STEM (Science, Technology, Education and Mathematics) education and STEM workforce. It's a growing concern in the US that in elementary, secondary high schools and colleges we're not producing enough engineers. iRobot is taking a position to help as much as we can to encourage STEM education so we get more workers into the engineering ranks.

SK: How do you foresee interaction between your company and RICC student teams playing out?

DM: We may get exposure to some team members who are looking for employment down the road, and I guess that would be it.

SK: What do you think the RICC can do to foster the relationship between your company and your industry and the academic community?

DM: Continue to promote this event and perhaps foster some interactive social events where there can be some mingling between our representatives and the students.

Mikell Taylor
Bluefin Robotics*
Conducted by Samuel Kaplan

* Mikell Taylor, at the time of the interview was and currently is employed by Heartland Robotics, but answered as if she were still at Bluefin Robotics.

Samuel Kaplan: How did your company become aware of the RICC?

Mikell Taylor: We became aware of the RICC because of the company president's involvement on the advisory panel for the WPI Robotics major. They asked David Kelley, our president, for a representative of Bluefin to be on the committee and I got nominated.

SK: Is your company a sponsor of or otherwise involved in any other collegiate academic events such as the RICC?

MT: We give some money to MIT who has something called the Blue Lobster Bowl; I'm not sure if that's a college or high school level kind of science quiz bowl event. On the collegiate level though, I don't think we sponsor any competitions. We do FIRST robotics teams as well but that's about it.

SK: What is your company's intended involvement in the RICC from a personnel standpoint?

MT: That kind of remains to be seen it depends on what the needs are. Since it takes place on a weekend in a lot of ways that's a good thing. It's easier to get people to go on the weekend instead of during the workday. From a personnel standpoint, obviously I'm on the steering committee. From a financial standpoint, I think you could certainly expect a small-level contribution from Bluefin, I mean it's not a very big company but I think that's possible.

SK: What does Bluefin expect to gain by being involved in the RICC?

MT: I think it's a name recognition issue, both for the students involved and for the companies involved. We want to be a part of the robotics industry and this is a good way to get our name out there.

SK: So then, your company places highest priority on name recognition as opposed to ideas for new innovations or interaction with student teams?

MT: Yeah, I think that the kind of ideas that will come out of this aren't really relevant to what Bluefin is doing. The underwater robotics market is very different from what this competition is going to be. And certainly it's possible that we'll get some employees out of it. But I think it's important for Bluefin to be showing they're a part of this.

SK: Do you have any goals for the RICC that you would like to see met in order for your company to participate in this event annually?

MT: I think it's important that there's some pretty diverse representation on the student side, that it's not even all just students from Massachusetts, but that we get some from neighboring states, and states from even further away, because there's a lot of ways to recruit students locally, it's harder to find out about them when they aren't within an hour's drive of the company.

SK: How do you see interaction between your company and RICC student teams playing out?

MT: I don't necessarily see a lot of interaction. Bluefin, as a company, we provide financial sponsorship or a volunteer here and there. But we don't really do mentorship necessarily and we aren't actively looking for new employees. If some come along that's great but I don't know.

SK: What do you think the RICC can do to foster the relationship between your company and your industry and the academic community?

MT: That's a good question; I don't know… I think the event as it is, is a great way to get students more focused on industry. Being at a university I think it's more research-oriented, so keeping the robots practical and focusing on the applications and not necessarily the technology itself I think is a good way to be doing it.