



**The Roxbury Robotics Team**

**TEAM 4361**

**8/25/14**

# DRAFT BUSINESS PLAN

## TEAM 4361: ROXBOTIX

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## 1.0 INTRODUCTION

### 1.1 FIRST

FIRST (For Inspiration and Recognition of Science and Technology) was founded in 1989 to inspire young people's interest and participation in science and technology. Based in Manchester, NH, FIRST is a not-for-profit public charity that designs accessible, innovative programs that motivate young people to pursue education and career opportunities in science, technology, engineering, and math (STEM) while building self-confidence, knowledge, and life skills.

**FIRST Links:** FIRST Website: <http://www.usfirst.org/>

### 1.2 Team 4361 Roxbotix

Roxbotix, Team 4361 in the FIRST Robotics Competition (FRC), is a relatively new team, having just completed its third season in the FRC, and its second season as a school-funded club with a faculty advisor. Although we are a small FRC team, of about 20 students we are planning to grow in the coming years, both in student membership, sponsorships, and the full impact that our team has on the community. Our mentors and students are dedicated and we have great plans for the future.

In our efforts to increase respect for and interest in science, technology, engineering, and math, our team builds a specialized robot every year to participate in that year's FRC. During our six-week build, students, with guidance from mentors, analyze the game's aspects and design and build a robot to play the game. Following our six-week build season, the robot competes at District and Regional events of the Mid-Atlantic Robotics division of FIRST, the goal being to qualify for and compete in the International Championship held in April in St. Louis, Missouri.

Being part of a FRC robotics team is not just about building a robot; it is about community outreach to further student involvement in STEM-related disciplines. With this in mind, this year, the team has begun giving demonstrations of its robot at Roxbury's Elementary Schools, Eisenhower Middle School, and Roxbury High School. The team has also given demonstrations of its robot at the Roxbury Public Library, Picatinny Arsenal, and the New Jersey State Fair. All demonstrations were well-received. This fall it is planning to assist with the formation of a robotics club at Eisenhower Middle School, which will compete in the

FIRST Lego League (FLL). In conjunction with Roxbury High School's Key Club, it will be participating in philanthropic events and activities.

FRC teams are run like small enterprises. Students work to procure the sizeable funds needed to enter the competition and build a competitive robot (approximately \$10,000 per season), find technical mentors to advise the team, design team marketing materials, and coordinate community outreach. In the FRC, it is very common for parent booster clubs to form around the team, to assist with these activities.

### **1.3 Mission Statement**

To:

- Increase student involvement and interest in STEM disciplines
- Increase community awareness of the value of and need for STEM educational opportunities in its schools

## **2.0 TEAM SUMMARY**

### **2.1 Team Structure**

To date, the team has had a very simple structure, consisting of a faculty advisor, and approximately 4 mentors, 3 of whom were parents of students on the team. All students in the high school may join the team. Students are expected to follow all school guidelines and safety policies while participating in robotics. No attendance requirement has been implemented thus far.

### **2.2 Student Time Commitment**

In the 2013-14 season, it was determined that each team member on average, spent 30 hours of time during the 6-week build season, 30 hours of time at competitions, and 10 hours of time on school, community, and off-season events. Attendance at build sessions was sporadic for all but 2 or 3 dedicated members. Although build sessions were held 6 days a week in January and February, there were typically only 5-7 students in attendance on any given day, making it very challenging to finish designing and building the robot in the limited 6-week time span. Going forward, we are hoping to increase the time commitment of students to 50 hours of time during the 6-week build season, 50 hours of time at competitions, and 20 hours of time at school, community, and off-season events.

Competing successfully in the FRC and carrying out the mission of FIRST requires a level of involvement similar to what is required by varsity athletic teams. Thus far, this has only be demonstrated by a handful of students, but we are hoping to change this.

### 3.0 GOALS

For the 2014-15 school year and the 2015 FRC, the team hopes to accomplish the following:

#### 3.1 Financial

- Form a Booster Club with 501(c)3 status to handle all purchasing.
- Raise \$5000 and find at least 2 sponsors who will contribute \$1000.
- Increase the school district's financial commitment to the program by \$500.

#### 3.2 Student Membership

- Increase student membership from 20 to 30.
- Increase average attendance at build sessions from 5 to 10.
- Hold students to an individualized predetermined level of commitment.
- Provide information to parents in December about the team, including written material and/or an informational session.
- Create and distribute a simple student handbook.
- Have at least 5 girls on the team.
- Make student involvement in Roxbotix be a year-round activity, including STEM-related educational opportunities throughout the school year and summer recess.
- In the fall, create subteams of students and/or student leads, including programming, engineering, build, game strategy, social media, tools, construction, marketing, . And mentor relations Provide learning activities relevant to the subteam/student lead.

### **3.3 Mentoring**

- Fund an assistant for Mr. Hayden for the build season.
- Find 4 additional mentors to advise the team, at least 1 of whom who has experience working with mechanical devices powered by electrical and/or pneumatic systems.
- Provide mentors a document detailing a mentor's role and expected level of commitment.

### **3.4 Facilities**

- Secure a lockable location in the high school for materials, tools, and/or robots.

### **3.5 Safety**

- Develop a comprehensive safety plan, with standardized operating procedures and guidelines.
- Provide safety training to all students prior to the 2015 build season.
- Arrange for our safety captain to meet with Aperture's safety captain.

### **3.6 The FRC Robot**

- Give careful thought to game strategy before designing the robot. Use quantitative analysis of scoring.
- Contact Mount Olive High School's Robotics Team (MORT) before designing the robot to see if a robot can be built that will work well with theirs during matches.
- Utilize CAD software such as SolidWorks or Inventor to design the robot.
- Consult with Sam Mills in early January for advice.
- Utilize MORT's facilities and tools to create at least 1 custom part designed using CAD software.
- Use the 3D printer to create parts for the robot.
- Design the robot with a theme, so that we will be capable of winning an Imagery Award. Incorporate the theme in the design of the pit and/or team uniforms.

### 3.7 The FRC Season

- Finish the season with more wins than losses in individual matches.
- Qualify for the MAR Championship with a ranking of 35 or higher.
- Qualify for the tournament at each of the district events we attend.
- Participate in other robotics' competitions, e.g., Monty Madness, Midnight Mayhem.
- Utilize Booster Club to manage team logistics.

### 3.8 Outreach

- Participate in at least 5 community events and 2 philanthropic activities.
- Assist in the creation of a robotics club at the Eisenhower Middle School. Regularly attend their meetings and mentor their students.

## 4.0 Challenges

Our challenges are focused on the sustainability of the team from an execution and monetary perspective.

**4.1 Membership Challenge:** As a newer team, we have smaller numbers than many of the established teams. In fact, the team in the 2013-14 school year only had 3 returning students, and survival of the team was in jeopardy. Lack of student membership is a challenge, particularly during the robot season, when there is much to be accomplished.

**Solution** By participating in the Roxbury High School Club Fair and high school events, such as fall football games, pep rallies, Key Club activities, Parent Orientation for 9<sup>th</sup> grade parents, the club's visibility will increase. Each student from the 2013-14 team will be charged with finding 1 additional student member for the 2014-15 team. By assisting with the formation of a robotics club at the middle school, the team will be creating a steady source of incoming freshmen who are interested in robotics, beginning with the 2016 season.

**4.2 Attendance Challenge:** Many of our team members are diverse in their interests and are a part of many other clubs and organizations within the school. Many students also hold part-time jobs. This has resulted in significant attendance challenges for the team, with only 5-7 students attending each build session.

**Solution:** We will continue to accommodate other activities and club involvement, but will have each student commit to a specific level of involvement at the beginning of the build season, so that student/time resources can be managed effectively. Parents of each student will be made aware of their child's time commitment. Failure to meet the time commitment will result in the student being ineligible to travel with the team to competitions and participate in team demonstrations.

**4.3 Funding Challenge:** To date, the team's funding has come primarily from very few sources, including the Department of Defense, and Mr. Hayden and his wife, the FIRST organization and the Roxbury School District. Below is a summary of expenses and income for the 2013-14 season.

### **2013 Season**

Expenses:

\$5000 FRC Entrance Fee  
\$5200 Robot Tools, Materials and Services  
\$1750 Advisor Stipend  
\$11750 Total Expenses

Income:

\$5000 Department of Defense  
\$2000 Grant from FIRST for all 1<sup>st</sup> and 2<sup>nd</sup> year teams  
\$3200 Mr. and Mrs. Hayden  
\$1750 Roxbury School District  
\$11950 Total Income

### **2014 Season**

Expenses:

\$5000 FRC Entrance Fee  
\$2000 MAR Championship Entrance Fee  
\$7600 Robot Materials, Tools, and Services  
\$1750 Advisor Stipend  
\$16350 Total Expenses

Income:

\$4000 Department of Defense  
\$2000 MAR Grant  
\$7600 Mr. and Mrs. Hayden  
\$1750 Roxbury School District  
\$16350 Total Income

Reliance upon so few sources is a risk to the survival of the team. If Department of Defense funding or the charitable contribution of Mr. and Mrs. Hayden is lost, unless other sources of income are found, the team will lose ability to participate in the FRC. Because Mr. and Mrs. Hayden met all of the team's material needs and a portion of the FRC entrance, and the team had so few returning members in the 2014 season, students were not involved in budgeting.

**Solution:** We will be conducting a significant and organized search for sponsors, to be carried out by the students and assisted by parents, Mr. Hayden, and other mentor, which will include a hierarchical reward strategy to show potential sponsors the benefits they will receive from donating to our team.

**SPONSORSHIP LEVELS:**

**\$5000 or more**

**"Platinum Sponsor"**

- \* Large logo and name on team shirt
- \* Large logo and name on competition robot
- \* Mentioned in press releases
- \* VIP status at competitions

**\$2500 or more**

**"Gold Sponsor"**

- \* Medium logo and name on team shirt
- \* Medium logo and name on competition robot
- \* Mentioned in press releases

**\$1000**

**"Silver Sponsor"**

- \* Small logo and name on team shirt
- \* Small logo and name on competition robot
- \* Mentioned in press releases

**\$500**

**“Bronze Sponsor”**

- \*Small logo and name on team shirt
- \*Small logo and name on competition robot

**\$200: Community Champion**

- \*Receive team shirt

**\$100: Community Advocate**

- \*Receive team picture

**\$50 or less: Community Partner**

- \*Team thank you note

Students will solicit sponsorships from local businesses and be involved in budgeting and the management of expenses. The team is also considering carrying out traditional fund-raising events and applying for government grants. Our team wishes for the parents of students to be more involved and connected to the team. Because of this, the parents are in the process of forming the Roxbotix Booster Club, which will be comply with the Roxbury School District’s booster club policies and achieve 501(c)3 status, to facilitate finding sponsors. The Roxbotix Booster Club will also coordinate meals for the team during the competition season, chaperones for trips that require more adults and transportation in case it is necessary. The purchasing policies of the Roxbury School District are poorly suited for the material and service needs of Roxbotix, much of which is not evident until the actual build season progresses, and requires a fast turn-around time. By making the Roxbotix Booster Club the source of funds for purchasing materials and services, the team’s needs may be met effectively and efficiently. It is likely that Mr. Hayden will carry out purchasing, and the Roxbotix Booster Club will reimburse him.

**4.4 Mentoring Challenge:** Mr. Hayden’s undergraduate degree is in systems engineering, not electrical or mechanical engineering, which are the disciplines in which skills are essential to building a competitive robot. Without significant mentoring in the areas, educational opportunities for the students are very limited, and the design and construction of the robot is mainly an exercise in common mechanical sense, resulting in an inferior product. To date the team has relied primarily on 1 parent for assistance in the design and implementation of mechanical devices. This is not a sustainable practice and has resulted in limited educational opportunities for the students. The involvement of mentors is most critical early in the build

season. In addition, frequently Mr. Hayden has been the only adult present at build sessions, greatly limiting his ability to safely manage students across multiple tasks.

**Solution:** Mr. Hayden, the students, and the Roxbotix Booster Club will look in the community to find more mentors. This team's exposure in the community will assist with this process. In fact, an appearance at a school event and off-season event has already yielded 2 engineering mentors, both of whom have experience in relevant disciplines. 1 of the new mentors works for a small company that produces specialized robots used by public safety agencies. Mr. Hayden has begun to reach out to MORT, the accomplished FRC team of our next-door neighbors. MORT is interested in mentoring our team and has already invited students to training sessions for their students. Mr. Hayden will also be reaching out to the engineering teacher at Roxbury High School. Mr. Hayden will work with his colleagues, mentors, and parents to ensure that each build session has at least 2 adults in supervisory roles.

**4.5 Facilities Challenge:** While the team has the tools and space necessary to hold team meetings and build the robot, the team does not have a secure place in the high school to store its materials and equipment, other than Mr. Hayden's classroom. With the team's growing supply of materials and tools, Mr. Hayden's classroom will no longer provide sufficient storage for the team. It was barely sufficient in the 2014 season, and will not be for the 2015 season. The team does have the ability to store materials in one corner of the high school's audio-visual equipment storage room. However, this space allocated to the team is not secure, and it is not obvious to maintenance employees that the materials and tools in this corner of the room belong to the team.

**Solution:** Mr. Hayden will work with Roxbury High School's Athletic Director, Mr. Mason, to find a secure location for the team's materials and tools. There is a lockable cage in the audio-visual room, that currently stores obsolete 28" televisions equipment, which is no longer used now that every classroom has a data projector and media resources are electronic. This would be an excellent place for the team's materials and tools. There are other locations that would also be suitable.

**4.6 Supervision Challenge:** One of the biggest challenges has been the sole adult supervising students at build sessions. This limited the team's abilities to work on multiple tasks simultaneously, and thus limiting the speed at which the team can design and build the robot, and reducing the learning opportunities the students.

**Solution:** Mr. Hayden will find colleagues and/or parents or mentors, who would be willing to supervise students one day a week, so that there are always two adults at build sessions. The parent booster club will fund an assistant for Mr. Hayden.

## 5.0 Conclusion

Despite limited financial support from the school district, Roxbotix has provided STEM opportunities for students at Roxbury High School, a school known primarily for its fine arts programs. Roxbotix was able to build a competitive robot in its second and third FRC seasons, winning the Imagery Award at a district event, and thanks to fortunate alliance selections, compete in the finals of a district event, finishing second in 2013, and winning the event in 2014. The program has much potential but is still in its infancy. By developing a partnership with local businesses, parents, volunteer mentors, and other teams, Roxbotix will be able to provide more significant STEM opportunities for a much larger number of Roxbury students, and be an advocate for STEM education in the community. The well-developed and extensive robotics programs of the Mount Olive school district, Roxbury's next-door neighbor to the west clearly demonstrates this. Mount Olive High School, home of the FRC team MORT and MORT Beta, is a school district approximately the same size as the Roxbury School District, and whose students have a similar socio-economic background. Their robotics programs provide STEM opportunities to students from all age groups. There is no reason Roxbury cannot provide such opportunities for its own students. With hard work, determination, and the wonder of applied science and technology, Roxbotix is up to the task.