Team 2537
2017 Business Plan

The Space RAIDers

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Introduction

The Point

Space RAIDers' 2017 business plan introduces the FIRST program, describes the history, philosophy and goals of the team, and details the team's business and technical processes, organizational structure, relationships, team risks and mitigations, and the team 2537's budget. It captures the team's past, present, and future.

The FIRST Program

The FIRST (For Inspiration and Recognition of Science and Technology) Robotics Competition (FRC) was founded to promote math, science, and engineering by engaging high school students in a "varsity sport for the mind." Atholton High School Team 2537, known as the Space RAIDers, is one of over 5000 FIRST Robotics Competition (FRC) teams participating in this rigorous and exciting program.

Each January a new competition is unveiled, and teams are given six weeks to design and build a robot which must function autonomously and semi-autonomously to accomplish a variety of tasks in a collaborative game. The robots are hand- built each year and include student-designed arrays of motors, motor controllers, wiring, and software to control them. The process includes requirements capture, design, prototype development, building, testing, and integration. Students apply academic skills such as calculus, geometry, physics, and computer programming, gaining experience in areas including business, project management, software development, systems, electrical, and mechanical engineering, parts fabrication, and Computer Aided Design.

The 2017 Game

The 2017 game, Steamworks, is played between two alliances of three teams each, with each team controlling a robot. Each alliance works to build pressure in their boiler by scoring "fuel" into one of the two boiler goals. Additionally, each alliance attempts to get their airships rotors turning by transporting gears to a peg on the airship, from which the alliances' pilots place the gears on the rotors and spin the rotors up. The game is played on a rectangular field with each team having a side. Each side has a tower as well as a boiler. On each side of the field are sets of hoppers containing fuel.

The game is split into two time periods: Autonomous phase and Tele Operational phase. During the fifteen second Autonomous period, the robots operate without the aid of a driver. Instead, robots must be programmed to operate solely on their code.

Points can be earned during this phase by scoring fuel in the boiler goals, getting rotors turning, or crossing the baseline.

After this fifteen second period, the drivers take over. This Tele Operational phase lasts the remaining 2 minutes fifteen seconds of the match. During this time, alliances work together to score goals as well as to start rotors. At the end of the match, robots can climb a rope that hangs from the airship to earn additional points.

Team Philosophy

Team Mission Statement

“Raiding ‘space’ for innovative and new technological ideas to develop the future.”

The team’s mission exemplifies the emphasis placed on improvement and progress that permeates throughout the Space RAIDers. From embracing a new agile development process to better achieve design and build goals, to teaching leadership skills to enhance members’ abilities to encourage and enable each other, to developing a new point-to-point autonomous program, the drive to innovate and improve is felt in every aspect of the team.

Team Vision Statement

“Expanding the culture of engineering, leadership, and teamwork throughout the ‘space’ of our community.”

The team’s vision encapsulates the focus the Space RAIDers place on improving the community that surround them. Through providing life changing experiences to members, generating interest in the community through demonstrations and presentations, and training future innovators, team 2537 tirelessly spreads the message of FIRST and the importance of STEM throughout the community.

Team Slogan

“Bright Stars. Bright Innovators. Bright Futures.”

The team’s slogan captures the greatest aspect of the team: the incredible impact it leaves on all those that pass through its ranks. By developing skills, encouraging growth, and providing meaningful experiences, team 2537 ensures that all of its members head towards brilliant futures.

Team History and Evolution

Inception

Team 2537 was founded in 2007 with seven students and a handful of mentors. The team's early robots, while well-intentioned, weren't exactly picturesque. Over the years, however the team grew in both numbers and engineering prowess, eventually reaching about 50 student members in 2013. Yet, it remained what it had begun as: merely a robot building club.

Reinvention

However, during the fall of 2013, Team 2537 reached a turning point. The team underwent a reinvention, during which the team's philosophy and mission morphed from its previous myopic viewpoint to a well rounded, full fledged FIRST team. While building a successful robot would remain an important goal, it would cease to be the only goal for the team. From then on, the team would make it their mission to spread FIRST values and aid other FIRST programs, holding them as every bit as important as just building a robot.

Today

This new philosophy has fully imbued itself into the culture of Team 2537 during the past four seasons. The team has fully completed its alignment with FIRST values. The past season, for example, the team started another team and participated in 14 separate outreach events. This year, the Space RAIDers continued on this path, participating in numerous events and offering assistance to any team that required it.

Team Accomplishments

Northern Maryland Competition

In the 2016 season the Space RAIDers competed with over 30 other teams at the Northern Maryland District Event. At this event, the Space RAIDers not only managed to be an alliance captain, but also managed to lead their alliance to a competition win for the first time in team history.

Dean's List

Dean's list award "celebrates outstanding student leaders whose passion for and effectiveness at attaining *FIRST* ideals is exemplary." As a testament to the

dedication of the team's members, the Space RAIDers have had a Dean's List finalist for the past 3 straight years.

Entrepreneurship Award

The Entrepreneurship Award celebrates the entrepreneurial spirit of a team by recognizing a team that has developed the framework for a comprehensive business plan to scope, manage, and achieve team objectives. The Space RAIDers are proud to have earned this award for 3 consecutive seasons.

The Team Today

Team Relationships

Relationships with team members, mentors, other teams, and the community are of the utmost importance to the Space RAIDers. This year, Team 2537 has strengthened its ties with its new team members by implementing the training program in the fall, which prepares them for the rigorous build season that awaits them and quickly integrates them into the team. Additionally, the team has made a concerted effort to use their leadership in a way that optimizes the membership experience.

However, Team 2537 doesn't cease to care about its members when they graduate. The Space RAIDers actively attempt to keep in touch with their alumni, both inviting them to an alumni facebook group and inviting them back to mentor whenever they can.

One of the most important relationships the team has is with its mentors. Most of the team's mentors joined when they had students in the program, but many stay with the team even after their children graduate. Some are so enthusiastic that they recruit other mentors, who have no ties to the school. When asked why they stay, many mentors will mention particular students, who they continue to advise and support long after the student graduates. These relationships have brought several team alumni back as full time mentors - this year we have five alumni mentors.

The team has excellent relations with its sponsors - many of whom are long-term supporters. The team send out newsletters regarding our accomplishments which they greatly appreciate as it keeps them informed of the team's successes and the value of the FIRST experience for our student participants. Additionally, Team 2537 give back to our sponsors by supporting their community outreach events and festivals. Finally, one of the priorities for Team 2537 is to have relationships within the community. The team has accomplished this by attending 14 separate outreach events during 2015, where the Space RAIDers demonstrated the team's robot to audiences ranging from elementary school students to members of Congress. It is this relationship that allows the Space RAIDers to maintain consistent support every year.

Team Structure

The Atholton Space RAIDers program is sponsored by Atholton High School, as part of the Howard County Public School System. Mr. Charles Lidard is the school's designated faculty advisor and has responsibility for the program. Mr. Lidard is supported by the Atholton Technology Boosters Club, which consists of parents who have students on the team, and coordinates the administrative support to the team. In conjunction with the Lead Mentors, the Boosters and the Operations team oversee all team financial activities, track income, approve expenditures, and set the budget for each subteam.

In addition to these people, team 2537 is supported by over 40 adult volunteers and mentors. Many of these mentors and volunteers have students on the team, while others don't, choosing to volunteer hundreds of hours solely because they find coaching students in STEM to be incredibly rewarding.

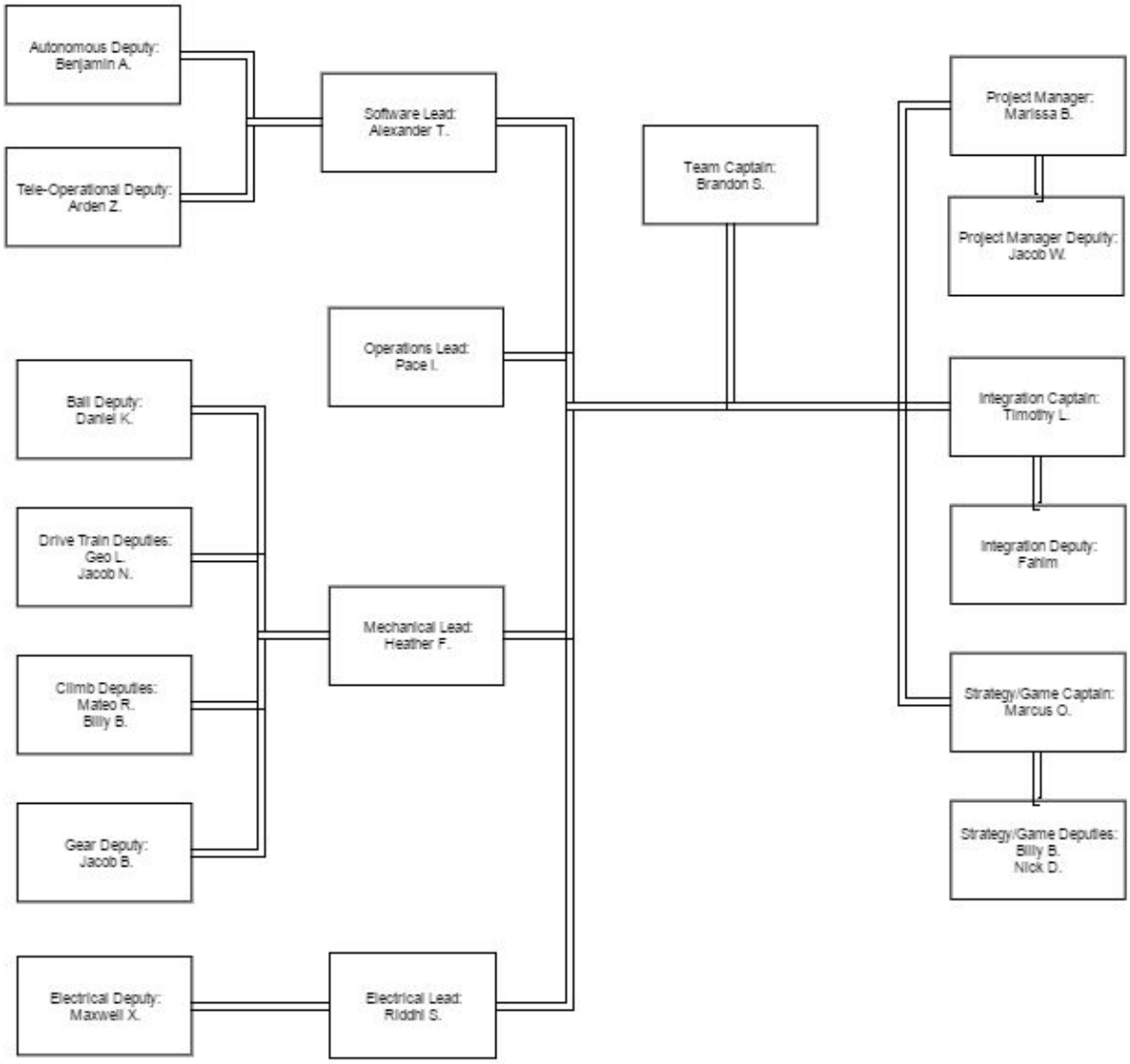
In order to raise funds, the students reach out every fall to the previous year's sponsors to request continued support. Additionally, students research and contact new sponsors every year in order to expand the team's funding sources, and work with parent volunteers to coordinate fundraisers.

The team recruits new students each year by demonstrating the robot at New Student Orientation and Back to School Night. Team members also actively mentor FLL teams at feeder middle schools, encouraging them to join the team once they reach high school.

This season, team 2537 embraced a new leadership ideology focused on having leaders serve their followers as opposed to the inverse. Reflecting this, the team gained additional captain and deputy captain positions to enable the various team leads to better execute their jobs. These leads in turn support their deputies, who help facilitate and aid the individual members of the team.

This year, the team added the Project Manager position, whose job was to organize the allocation of resources between subteams as well as help manage subteam deadlines. Additionally, the Integration Captain position was broadened to include organizing space on the robot and assisting with deadlines as well.

The specific separation of roles amongst the team is detailed in the chart below.



Resources

The Atholton High School Space RAIDers program has access to a number of resources provided by the school and by FIRST to aid in our program. The table below outlines those resources.

Resource	**Description**
Fully Equipped Machine Shop	Drill press, band saw, Grizzly, 3D printer, routers, CAD equipment, hand tools
Previous Year's Robots	Sample components, reusable parts, design principles

FIRST Resources	Every year at the Kickoff (first Saturday in January), FIRST Robotics provides a "kit of parts"—or a voucher for team selected parts—that can be used to help build the robot. They also provide or sponsor many online resources to help solve problems.
Team 2537 Social Media	Team 2537's website www.team2537.com provides a platform for our team to post news, videos, and instructional material for and about the team. Led by an alumni mentor, the team rehosted in Wordpress, to separate the site framework from the content management. Additionally in January 2016, team 2537 launched a public facing Facebook page (the Space RAIDers continue to use the team's private Facebook page for internal updates and communications).
Documentation	The Atholton High School Technology Boosters Club, in collaboration with the school administration, has developed documentation to support team organization, administration, and succession planning to reduce risk for future years as parents, faculty, and mentors leave the team. The team membership agreement and a team handbook were completed in 2014, and we now have a first draft of a parent volunteer handbook, with the goal of engaging more parents by defining specific and time-bound tasks that they can do to help the team.

Financial Statement

Team 2537's total budget last year was almost $40,000, including competition registration, robot parts, transportation, marketing (including uniforms), meals, etc. To keep the costs low, Team 2537 continued its cost effective processes for purchasing parts. The team continued its philosophy of "always try the least expensive thing first" and planning ahead to help avoid excess shipping costs. These measures enabled the team to continue to maintain their trend of keeping robot building costs low.The general decrease in costs across the board from the 2014 season to the 2015 season reflects a general improvement in spending efficiency. The increase in competition budget includes funding that is allocated in case the team qualifies for attending District Championships and World Championship.

Comparison of Budget Distribution Between Years

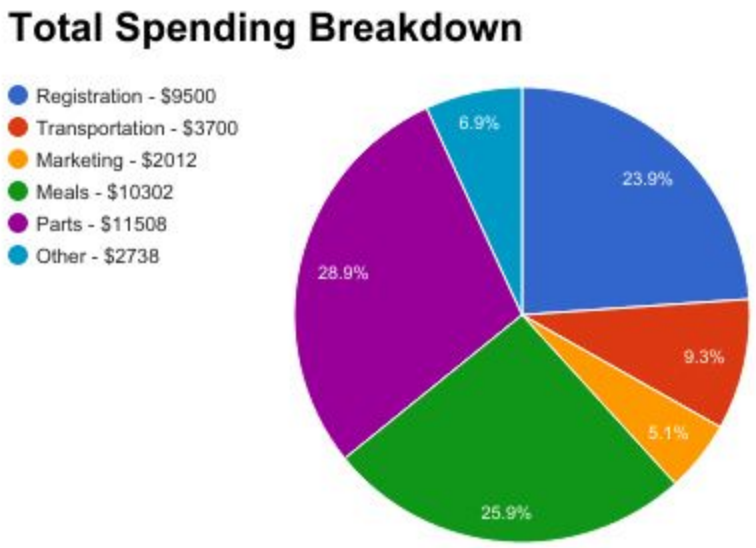
Activity	Cost for 2014-15	Cost for 2015-16	Cost for 2016-17

Competition Registration	10000	9500	13450
Transportation	4725	3700	4700
Marketing	3572	2012	2500
Meals	8603	10302	9000
Parts	13297	11058	10000
Other	2819	2738	3500
Totals	43016	39310	43150

Projected Expenditures from 2016-2017 Season

EXPENSES	BUDGET	Comments
Registration Fees	$13450	Includes two District competitions, two off season competitions, one District Championship and Championship. Note that depending on team performance, we may not qualify to attend the Regional and the Championship.
Parts/Equipment/Shipping	$10000	for Protobot, Competition Bot, and Pit(assumes reuse)
Transportation	$4700	Buses for competitions, truck for robot/pit transport
Meals	$9000	Student and mentor weekend meals during build season, plus snacks, drinks, award banquet

Shirts/Uniforms	$2500	
Marketing/Outreach	$2500	Banners, buttons, brochures, beads, handouts at competitions
TOTAL EXPENSES	**$47675**	



Actual Expenditures from 2015-2016 Season

EXPENSES	**2016 actual cost**
Registration Fees	$9500
Equipment	$11058
Transportation	$3700
Meals	$10302
Shirts/Uniforms	$2738
Marketing/Outreach	$2012

TOTAL EXPENSES	**$39310**

In order to support this large of a budget, team 2537 raises funds from two primary sources: sponsors and a membership fee. The membership fee primarily assists the team with paying for items like meals, which are felt to not be the responsibility of the sponsors. On the other hand, the team's generous sponsors, who provide the majority of the funding for the Space RAIDers, enable the team to pay for registration, parts, and other such essential items. Finally, the team also pursues supplementary fundraising to further boost the team's monetary resources.

Actual Revenue from 2016-2017 Season

INCOME	**2017 actual revenue**
Sponsors	$24750
Membership Fee	$11719
Other	$98
TOTAL INCOME	**$36567**

Risk Analysis

The Atholton Robotics team participation in FIRST Robotics faces a number of technical and administrative challenges. These are outlined in the following table.

Challenge / Risk	**Mitigation**
It takes at least $40,000.00 per year to successfully fund a Robotics program the size of Space RAIDers. This represents a significant fundraising challenge.	The team has been remarkably successful in establishing and maintaining long-term partnerships with large and small regional technology companies. This is partly due to the team's communications and outreach to these companies, as well as the open invitations they have to visit us during build season, cheer the Space RAIDers on at competitions and mentor the students.

	Team 2537 is also planning and implementing fund raising opportunities such as concession sales, pizza sales, and profit sharing with local restaurants. The team established a "participation fee", paid by parents or student members, which covers the costs of food during build season, as well as team uniforms. This separation of funding and expenses ensures that grants and sponsor funding goes strictly towards robot build costs, competition registrations and transportation. In addition, the Space RAIDers maintain our inventory list to ensure that we can reuse parts, and continue to use our Standard Operating Procedures to keep costs under control.
Technical challenges to building complex robots for FIRST Competitions.	Atholton High School provides access to its shop resources—including a Computer Aided Design (CAD) laboratory, machining and manufacturing tools like 3D printers, Grizzly mill, drill presses, bandsaws and hand tools. The team continues to recruit strong mentors from industry with backgrounds in fabrication, engineering, and software development to mentor the students. Interest in this is growing and the team now has more than 20 adult mentors.
Continued School Sponsorship	In order for the Atholton High School program to continue, the team need support from the Howard County Public School System and Atholton High School in particular. Atholton continues to provide significant support to the team, viewing its members as the school's "science athletes". However, the time required to support the team during build and competition season makes it difficult for a single

	faculty advisor. The Space RAIDers continue to work closely with the school's leadership and Tech Ed faculty to ensure the team have the staff support necessary so that the team can use the school as needed. The School Principal, Activities Manager, and the Howard County School board have gone on record as being dedicated to the long-term support of FRC Robotics activities at Atholton High School.
Managing Student Engagement	While the team has no issues with recruitment, the Space RAIDers' challenge is how to give the large number of interested students a meaningful experience that actively engages them. Once again this season the team has more than 70 students total on the team. The Space RAIDers continue to explore approaches to managing such a large team. In order to improve the member experience, the team adopted a new leadership strategy that made it such that leaders focused on serving their members, ensuring that members feel that the team's unique opportunity benefits them. Team graduates are now pursuing engineering, math, and science degrees at Virginia Tech, University of Maryland, Penn State, Rochester Institute of Technology, Case Western Reserve, Worcester Polytechnic Institute, and UMBC, among others. In addition, the team's students participate in internships at places like Johns Hopkins Applied Physics Lab, NASDAQ, and NASA-Goddard, as well as in NSA summer programs.

Additionally, each of the subteams on the Space RAIDers faces unique challenges and risks that each must handle. These are outlined below.

Challenge / Risk	**Mitigation**
The operations subteam needed to handle the subteam's largest member turnover	During the transition from the 2016 season to the 2017 season the operations subteam experienced great membership changes. After the end of the 2016 season, 50% of the operations members, including 3 team leads and captains, graduated. At the same time, the operations team experienced great growth, gaining the largest number of rookie members in the subteams history. In order to be able to continue working at the subteam's ambitious pace, the subteam created documentation to support greater time management and task prioritization. Additionally, the team worked to improve communication, sending summary emails after each meeting to update absent members about the tasks that were accomplished at each meeting.
The mechanical subteam had to handle the logistic problems that arose from relying on offsite meetings.	Due to an inability to schedule meetings at the standard meeting space on Sundays, the team needed to relocate to offsite locations such as STEMAction or Hackground to stay on schedule. In order to ensure that these relocations went properly, the mechanical team needed to locate and pack the appropriate tools and materials before moving. From there, the next largest challenge was actually transporting these items. In order to handle this challenge, the mechanical subteam would split the tools between multiple members'

	vehicles to allow for easy transportation.
The electrical subteam needed to handle the technical and logistic challenges required to wire a fully functioning FRC robot	This year the electrical subteam faced difficulties with implementing the lidars and the shield, as well as spacing for electrical and raspberry pies. A new issue that the electrical subteam faced was mounting the electrical board on the side of the robot. To mitigate the risks this presented, the electrical subteam added a shield to protect and stabilize the board during matches. The shield was an issue, though, as it was hard to properly mount it. To solve this issue, the electrical subteam drilled holes into the electrical board to. Cutting the aluminum for the shield also proved challenging, on account of the not having access to the ideal tools. The raspberry pies also created some difficulty, requiring the electrical team to rewire it in order to ensure that it functioned properly. Additionally, the lidars were the source of some challenge, as they required time to acquire, which delayed the subteam.

Future Outlook

Team Goals

One of the primary aspects of the current team that delineates it from its earlier forms is team 2537's sizable funding, provided primarily through the generosity of the team's sponsors. This, however, can still be improved through better relations with sponsors as well as continued expansion into alternate funding sources, whether said sources are unexplored potential sponsors or alternative fundraising methods. Thus, as team 2537 progresses one of its primary continuous goals is the continued acquisition of funds.

The most major way that team 2537 plans to go about this goal is the exploration of new groups of potential sponsors that have not been previously engaged. For instance,

the team may pursue relationships with local businesses that are not STEM related to complement the currently technology dominated sponsor pool who so generously support the Space RAIDers.

Additionally, the team plans to explore non sponsor based forms of fundraising to improve the team's funding base. Such fundraising, which may range from collaborating with local businesses to holding team organized and facilitated fundraisers can help play a supplementary role to the funding of sponsors while enabling the team to pursue greater endeavors.