

Business Plan



HVA RoHAWKtics

FIRST Team 3824

2017

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I. Executive Summary

Mission Statement

The HVA RoHAWKtic's mission is to engage students in the business of science and technology by introducing students and the community to new and innovative technologies and designs, establishing a sustainable and competitive program, and providing a foundation for students' future endeavors in the workforce and STEAM (Science, Technology, Engineering, Arts, and Mathematics) community.

Team Basics

The Hardin Valley Academy (HVA) RoHAWKtics was established in 2011 by a computer science teacher, Mrs. Mary Lin. The lead mentor roles were later taken up by two other HVA teachers, Mr. John Tilson and Mrs. Beth Love. In the team's inaugural year, there were 13 members; the team has since grown to 56 members, a 331% growth. The team moved from an HVA school closet to Oak Ridge National Laboratory's (ORNL) National Transportation Research Center (NTRC) and Manufacturing Demonstration Facility (MDF) in 2012.



The HVA RoHAWKtics work at the MDF and NTRC buildings during build season. The team has worked here six out of their seven years.

Successes

The HVA RoHAWKtics' successes are reliant on incorporating cutting-edge technologies, such as additive manufacturing (3-D printing) and pultrusion, and involvement in education. Because the team works at government facilities, members have the opportunity to work side-by-side with professionals using advanced machinery. To educate the community, the team works numerous volunteer outreach events, including parades, visits to elementary and middle schools, and bringing the team-made t-shirt cannon, the NightHAWK, to sporting events. The team can further its mission towards prospective members and the community. The team also hopes to further its global outreach through its annual ERSTE (Encouraging Robotics and STEAM Through Exchange) Initiative. This is a German exchange program where the team has set-up a *FIRST* team there and invites German students to come to Knoxville.



The HVA RoHAWKtics marching in the Farragut Fourth of July Parade with an interactive robot for spectators in Farragut, Knoxville.

The team hopes to expand its influence not only nationally but also globally through the creation of new competitive robotics teams and increase marketing of STEAM education.

II. *FIRST* Description

FIRST Basics

FIRST (For Inspiration and Recognition of Science and Technology) is an international, nonprofit organization founded by Dean Kamen in 1989. It oversees the *FIRST* Robotics Competition (FRC), *FIRST* LEGO League (FLL), *FIRST* LEGO League Jr. (FLL Jr.), and *FIRST* Tech Challenge (FTC) competitions. *FIRST* strives to inspire prospective leaders in the STEAM

community and engage students in a program that promotes the development of life and STEAM-based skills.

Core Values

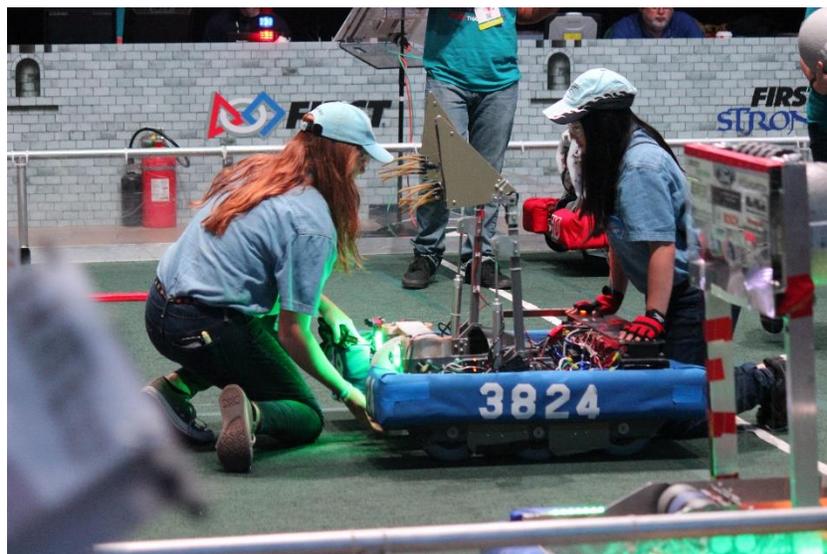
One of *FIRST*'s chief values is *Gracious Professionalism*®. First coined by Woodie Flowers, who began working with Kamen and *FIRST* in 1990, it holds that a team not works in a competitive environment but also behaves in a respectful and helpful manner towards others. It encourages teams, as well as individuals, to act with integrity and empathy within and out of the STEAM community.

Coopertition® is another chief value of *FIRST* based on the belief that teams should assist each other even while in the heat of competition. It promotes the display of altruistic and respectful behavior towards other teams in and out of competition. It also encourages teams to continuously learn from its members, mentors, and other teams while improving themselves.

III. Team Description

FIRST Robotics Competition

The HVA RoHAWKtics' is a member of *FIRST*'s FRC program, which has been dubbed by *FIRST* as the "ultimate Sport for the Mind". Teams must build a robot that meets certain rules and guidelines for a game released the first week of January. Teams have six weeks to build their industrial-sized robot then compete in the hopes of attending the *FIRST* Championship at the end of competition season. The other side to the team involves the journey to spread STEAM education and *FIRST* principles throughout the community and even the world by creating and attending outreach events and helping to start and maintain other *FIRST* teams.



Two members with the HVA RoHAWKtics' 2016 competition robot at the *FIRST* Championship in St. Louis, MO.

Differences from Other Teams

The HVA RoHAWKtics share core similarities with other *FIRST* and FRC teams, but the team does differ from others. For one, the team is the only *FIRST* team still able to work at the ORNL facilities in Knoxville. Due to this, the team uses large-scale 3-D printing (one of the team's robots was once the largest 3-D printed structure in the world) and pultrusion, a material technology gaining popularity. The team has also gained government dignitaries through its affiliation with ORNL. The HVA RoHAWKtics also host an FLL Qualifying Tournament at HVA, attracting hundreds of people. The team was the first one to create a promotional t-shirt cannon for sporting events in the area too. Members can participate in outreach events other teams do not, like the Barnes & Noble® MakerFaire, an event held at the store on Kingston Pike in Knoxville where about a thousand-people attended. The team also has its ERSTE Initiative (*erste* is actually German for *first*), laying a foundation for other teams to follow. Members host students from Germany for a couple weeks, taking them to competition, school, and on family activities. The roles are then reversed as the team's members go to Germany and help spread *FIRST* throughout the country and Europe.



The HVA RoHAWKtics with the German exchange students and mentors

Market Served

The market served by the HVA RoHAWKtics is the STEAM community, the individuals involved in the five components of STEAM.

- **Science:** The team provides an environment that fuels analytical thinking by hypothesizing and creating steps to solve problems, whether it be building a robot or creating new marketing strategies.
- **Technology:** Members and the public alike are exposed to new and interactive tech that subsequently grows interest in the program and other fields.



The HVA RoHAWKtics with one of their robots, Pultruder, at Blue Grass Elementary School for its educational STEM Night

- **Engineering:** Students get to work with professional engineers and spread the knowledge gained from those interactions with the community through demonstrations.
- **Arts:** The team has professional photographers as mentors and ones that work in graphic design, letting members learn and apply such skills. Students have opportunities to design logos, flyers, signs, shirts, and other items requiring artistic abilities.
- **Mathematics:** Members use math in all aspects of the team. Such calculations are needed for the engineering side but also for business to figure out growth and retention rates.

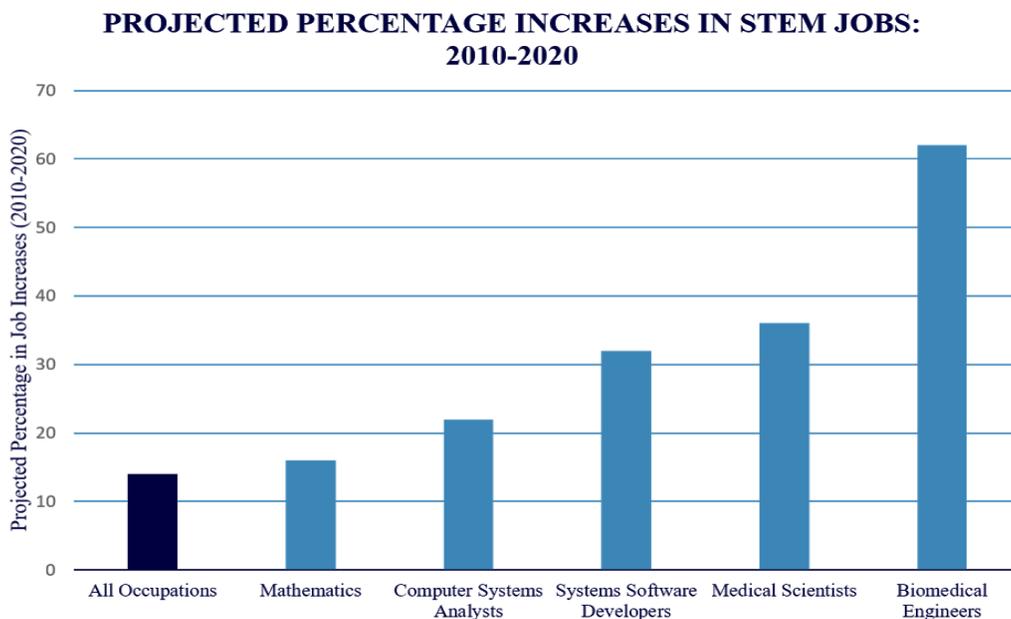
These five components are imperative to both the team and community as such knowledge and skills are made available to the public, increasing the size of the market and, therefore, the team's influence.

IV. Market Analysis

Market Research

The STEAM community stretches across students, companies, and other members of the community interested in STEAM ideas, but the focus of the HVA RoHAWKtics is spreading that education to younger generations (high school and below) to prepare them for the workforce.

- According to the Bureau of Labor Statistics, STEM (Science, Technology, Engineering, and Mathematics) careers in the U.S. are expected to grow 13% from 2012 to 2022.



This graphic is provided by the Department of Education.

- The National Science Foundation reports that Tennessee, as of 2011, has one of the lowest percentages of science and engineering degrees in the U.S., ranging from 20.4% to 26.1%. The national average is 29%.
- The Department of Education reveals that only 16% of high school seniors are “proficient in math and interested in a STEM career”.
- The median earnings for science and engineering jobs in 2012 was \$78,270, while the median salary for all other jobs was \$34,750 according to the NSF.

STEM Careers vs. Other Careers (Median Earnings in 2012)



This information is from the NSF.

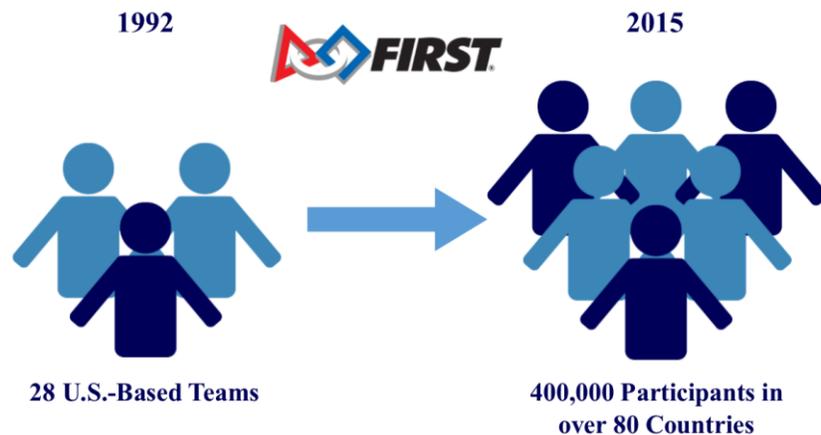
- The Georgetown University Center on Education and the Workforce found that 35% of those with a Bachelor Degree in STEM earn more than those with a Master's in "non-STEM". It was also found that 47% of those with a Bachelor Degree in STEM earned more than those with PhD's in "non-STEM".

These statistics only involve STEM principles because the STEAM Movement is still a fairly new concept. This year is the first year that STEAM is really being pushed by *FIRST* instead of STEM.

FIRST Research

The following information is provided by *FIRST*.

- Participants are two times more likely to major in science and engineering.
- 75% of *FIRST* alumni are in STEM fields, whether as students or professionals.
- The program has experienced a 6,040% growth in number of teams in its 26 years.

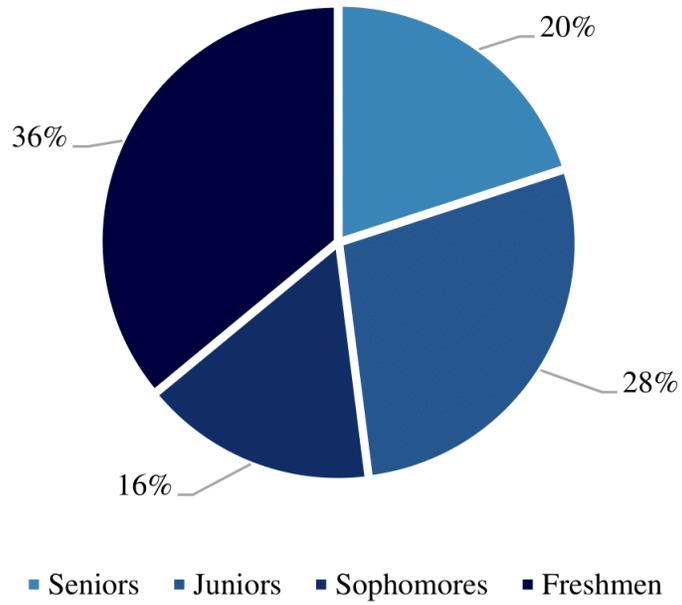


Information provided by *FIRST*.

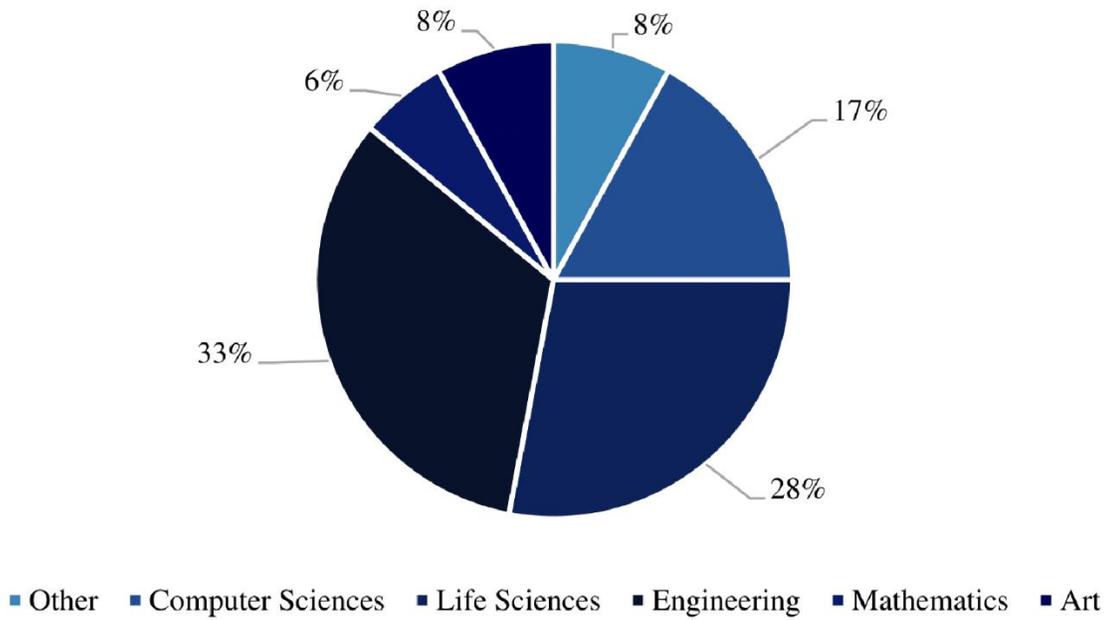
Team Research

- **Size:** There are 18 mentors and 56 student members, giving a mentor-to-student ratio of about 1:3.
- **Growth:** The team's first year included 13 members. With this year's number being 56, the growth of the team comes to 331%.
- **Sponsors:** The team currently has 14 sponsors, which are—
 - UT-Battelle
 - Manufacturing Demonstration Facility (MDF)
 - Oak Ridge National Laboratory (ORNL)
 - Knox County Schools
 - Naoko Blue and Associates
 - Electric Power Research Institute (EPRI)
 - Bechtel
 - Consolidated Nuclear Security (CNS)
 - Strongwell
 - Soccer Taco
 - Tennessee Valley Authority (TVA)
 - Magnum Venus Products (MVP)
 - Institute of Electrical and Electronics Engineers (IEEE)
 - Aluminum Company of America (Alcoa)
 - Techmer PM
 - The Sharp Companies
- **Demographics:**
 - 25% of the student members are female.
 - 50% of the team is composed of new members.
 - 86% of alumni go on to study and work in STEAM fields.
 - 1:3 mentor-to-student ratio.

Class Breakdown



Careers Members are Interested in



SWOT Analysis

The HVA RoHAWKtics is a large team by *FIRST* standards located in two ORNL facilities during the six week build season and at HVA during the remainder of the year. The team participates in two regional events, one in Palmetto, SC and the other in Knoxville, TN. If the team qualifies, as it has done six out of its seven years, members go on to the international *FIRST* Championship located, now, in Houston, TX.

Strengths	Weaknesses
<ul style="list-style-type: none"> • Organization • Number of members/mentors • Resources • Knowledgeable mentors • Familial involvement • Documentation 	<ul style="list-style-type: none"> • Limited student participation • Sponsor loss • Design issues • Sustainability • Lack of diversity
Opportunities	Threats
<ul style="list-style-type: none"> • School support • MDF/NTRC/ORNL • Sponsors • Outreach • Innovative technologies • Social media • National recognition • German exchange program 	<ul style="list-style-type: none"> • Other teams • Other organizations • Inclement weather • Losing privileges at the MDF • Dilution of funds • Mentor loss • Sickness

Members work to eliminate risks and maximize strengths. The team prides itself in these strengths, like experienced mentors who, many being ORNL employees, work with students. The 1:3 mentor-to-student ratio lets students gain experience by leading prototyping groups, have a voice in design, and forming bonds with mentors. The large number of members allows the team to have several sub-teams, each with its own goal. However due to the dedication that *FIRST* requires, many new members cannot attend every meeting; thus, older members assume more tasks and attend outreach events more often. Another weakness is the team's lack of diversity. Most members are white males who are enticed by the robotics aspect, so sub-teams regarding design and construction are often larger than others. The team has been given many opportunities though. The school allows the team to host events to raise STEAM awareness, and social media lets word spread about such events. Mentors aid the team by allowing members to use advanced equipment and facilities. A threat to the team is the dilution of funds from the creation of local teams. Other teams may outperform the HVA RoHAWKtics, causing sponsor loss. Harsh weather and sickness prevent members from attending meetings too. There is also the fact that some mentors will retire, so the team encourages new parent involvement. To prevent sponsor loss, the team continues Dignitary Day, an event where sponsors are invited to tour the facilities and speak with the team, and other updates, such as thank-you notes, brochures, and an annual team photo. Members must also comply with the rules provided by ORNL when working in its facilities.

V. Organization and Management

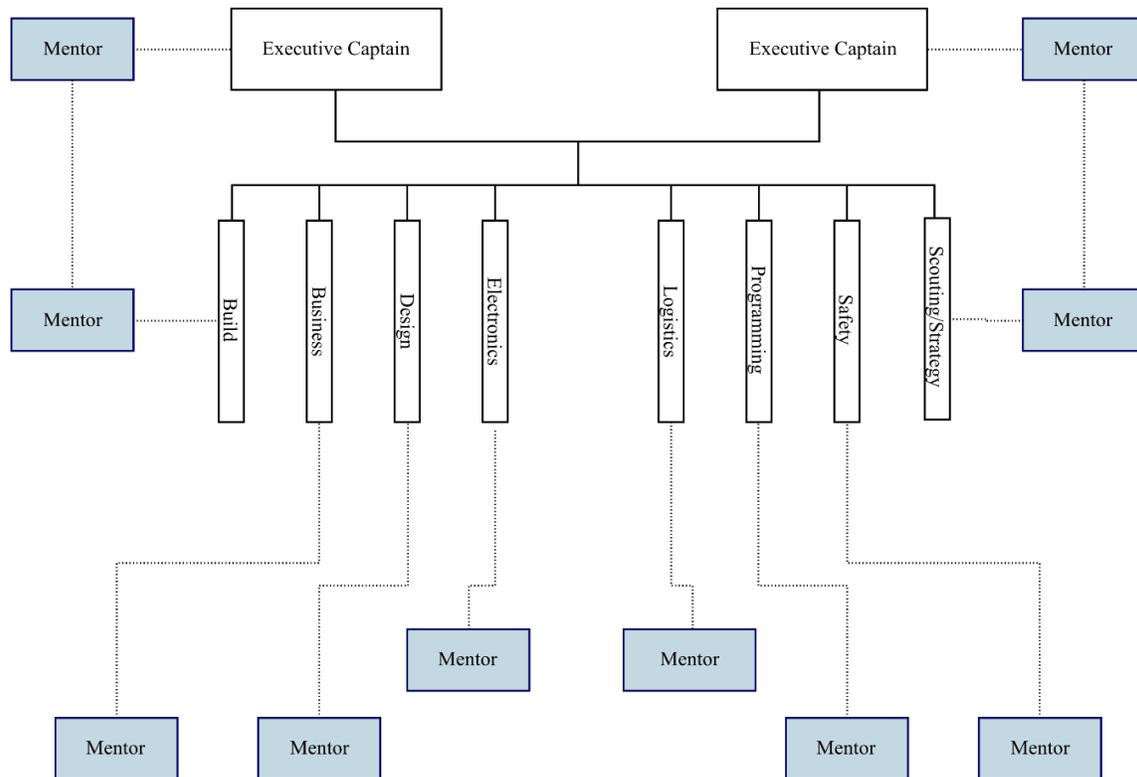
Organizational Structure

The HVA RoHAWKtics' team is separated into eight sub-teams, which are build, business, design, electronics, logistics, programming, safety, and scouting/strategy.

- **Build:** Members apart of this sub-team are in charge of robot construction, from the competition robot to the NightHAWK.
- **Business:** This team's responsibilities include award submissions, planning outreach events, updating website and social media, documentation, and marketing.
- **Design:** Students work to plan and sketch prototypes and integrate designs. They also help make flyers and informational sheets for the team.
- **Electronics:** This sub-team checks and plans wiring and pneumatic systems along with other items associated with electronics in the robots.
- **Logistics:** Students work to create checklists from each sub-team of materials needed to get ordered in a timely manner, kept track of, and brought to appropriate events. This sub-team also works with Business to create sign-ups for outreach events.
- **Programming:** Members code the robot to do tasks at events, specifically competition. They must program the robot for both the autonomous time (no human drivers) and the teleoperated period (human driven).
- **Safety:** This team provides education information on how to be safe while simultaneously enforcing safety mandates set by *FIRST* and ORNL.
- **Scouting/Strategy:** Students on this sub-team investigate past years' games and conducts research on other teams. They also design a scouting app to scout robots and teams while at competition for potential alliance members to effectively and efficiently gather data and present it in a meaningful way to the rest of the team.

Each of the sub-teams has two co-captains, typically an upper and lower classman. There are also two executive captains that oversee the whole team that were once sub-team captains.

Mentors work side-by-side with students on all levels of organization to spread experience and foster ideas made by students. This ensures that students do not work for mentors but alongside them so both parties benefit from the interaction.



Lead Mentors

There are two lead mentors, Mr. Tilson and Mrs. Love, who watch over the team and help everyone stay involved. Both of them took over after the team’s founder, Mrs. Mary Lin, could no longer participate after the first year. Mr. Tilson is a physics teacher at HVA and Mrs. Love was a former English teacher at the school but now works with homebound students and substitutes.

VI. Service and Product

Service

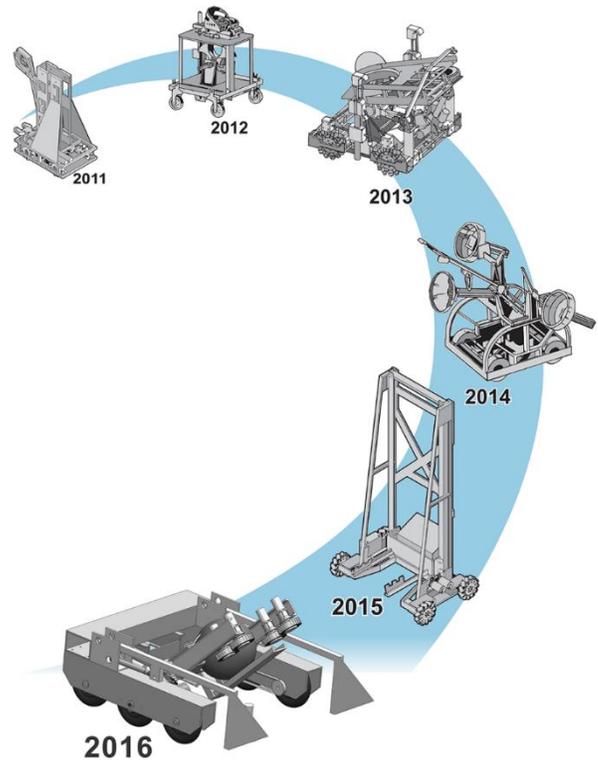
The HVA RoHAWKtics provides the service of spreading knowledge, technologies, and STEAM and *FIRST* ideals through the community; the benefits of such are seen through the growing interest in the team and what it stands for. The team is asked year after year to return to certain outreach events, like football games, Barnes & Noble MakerFaire, Farragut Fourth of July Parade, STEM nights at elementary and middle schools, and hosting an FLL Qualifying Tournament. Kids are exposed to *FIRST*, growing interest and leading to more participation in events like FLL, FTC, and FRC. Other members of the community also realize the applications of what the team does in the workforce.



The HVA RoHAWKtics with TN Governor Bill Haslam in 2013.

Product

The HVA RoHAWKtics' produce robots for competition and outreach. The team has six weeks at the start of January to build the annual competition robot. This robot is different every year as it must perform tasks based on the game video and manual released. The competition robot allows students a chance to work hands-on with innovative technologies and apply knowledge they have learned in school, like programming, physics, and mathematics. Students also have the opportunity to exercise teamwork in a competitive environment with time constraints. After the season is over, these competition robots are often reused in outreach, especially ones that can be used to interact with people. The team also has the NightHAWK, the t-shirt cannon, that is used solely for outreach at sporting events. Its purpose is to market the team and sponsors (members shoot sponsors' t-shirts) and excite the crowd at games.



The HVA RoHAWKtics' competition robots from their inaugural year to last year.

VII. Marketing Strategies

Member Recruitment and Retention

Recruiting members is vital to ensuring the HVA RoHAWKtics' growth. This is achieved by:

- Attending HVA's club-recruiting events, such as 8th Grade Night and Valleypalooza
- Placing signs and flyers around the school and community
- Having the NightHAWK at school sporting events
- Networking through team members and mentors
- Demonstrations at community outreach events
- Keeping a presence on multiple platforms of social media



The HVA RoHAWKtics' NightHAWK, which shoots t-shirts, at a home football game.

The team's plan to recruit more starts with personally talking to other organizations at HVA, especially ones who are not normally associated with robotics, such as art and photography clubs. This will help the team acquire more diversity within the team and bring in people with different perspectives and ideas.

Retaining members is the next step. This is done through:

- Opportunities to be promoted to leadership positions
- Strengthening interpersonal skills
- The chance to add points on college, job, and other types of applications

- Working with professional mentors, innovative technologies, and in state-of-the-art government facilities
- Volunteering in outreach events, which can be used for volunteer hours
- Opportunities to travel across the country and world
- The chance to be put up for an award at competition, called Dean's List

Mentor Recruitment and Retention

The HVA RoHAWKtics pride themselves on their knowledgeable mentors. To make sure this is always the case, mentors are recruited by networking with:

- Student members
- Current mentors
- Sponsors
- Schools that members attend

To recruit more mentors, the team is beginning to stress getting families more involved so that there is more support from home and the integration of more diverse backgrounds for mentors.

The retention of mentors is also emphasized to keep the program sustainable. To do this, the team:

- Spotlights mentors on the website
- Incorporates them in much of the processes
- Stresses their importance to the team
- Puts one up for an award at competition, called the Woodie Flowers Award

The only real plan for keeping mentors is keeping them interested and appreciated to convince them to stay, especially after their kids have graduated in many cases.

Sponsor Recruitment and Retention

Sponsors are an important part of the HVA RoHAWKtics since they provide the team with majority of its funds. To recruit more sponsors, the team:

- Attends outreach events
- Does demonstrations for companies
- Supplies a sponsorship brochure, outlining the levels of sponsorship and incentives for each
- Networks using student members and mentors

A plan thought out for next year is to implement the use of student-made pitches in which those students will go out to local business and ask for donations and sponsorships.

Sponsorship retention is vital to ensure funds are available for the team throughout the years. This is done by:

- Sending thank-you notes at the end of build season
- Spotighting sponsors on the robot cart, over announcements at competition, in the team's pit for the public to see, on the website, and in the business plan, depending on their sponsorship level
- Sending an annual team picture
- Hosting a Dignitary Day

The team hopes to strengthen the retention among sponsors by inviting them to more outreach events that members are a part of and sending more updates throughout the season instead of just at the end.

Team Marketing

Marketing is an essential component of the HVA RoHAWKtics as it gets the team's name out to potential members, mentors, and sponsors along with the rest of the community. To promote the team, members are continually:

- Staying present on social media
- Working with the school
- Appearing in news media, such as newspapers, television, and radio
- Attending outreach
- Shooting team t-shirts at sporting events
- Handing out buttons, flyers, and brochures at events
- Putting flyers up around the community
- Running charity events at the school
- Keeping an up-to-date website filled with all the team's information

Branding

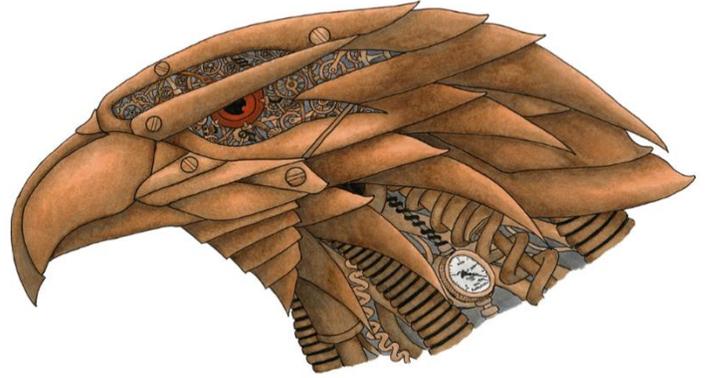
Branding is an integral part of the team's program. It helps to promote and market the team and make it more recognizable at events. Examples of branding for the HVA RoHAWKtics include:

- Integrating team colors, Carolina blue and navy blue, on all flyers, brochures, shirts, website, etc.
- Including the team logo on uniforms and marketing items

- Adapting the logo to promote the game being played that year, while keeping the original one (as seen below)
- Wearing a different t-shirt for each day of competition and a hat worn every day



The HVA RoHAWKtics' main team logo.



The HVA RoHAWKtics' promotional game logo, based off of this year's STEAMWORKSSM. This was created by one the team's members.

VIII. Funding Request

Current Funding Requirements

The HVA RoHAWKtics' budget is around \$80,000. This money mostly comes from sponsors (~\$40,000), then team fees (\$400 per member), and then donations (~\$600). The team, therefore, relies heavily on the continuance of funding, especially from sponsors, who range from local businesses to international corporations. The money goes to travel, hotels, buses, materials, uniforms, promotional items, and competition entry fees. The time period covered by the money received normally lasts a competition season (January through April). Any leftover money goes towards off-season outreach activities. All finances are kept track of through HVA's foundation and specifically through an adult bookkeeper affiliated with the team.

Future Funding Requirements

As the team continues to grow, so does the amount of funds needed to support the team. If the team qualifies for the *FIRST* Championship, which takes place in April, the team must go to the competition in Houston, Texas. Due to the long distance, the team is unable to take a bus to the competition and must instead travel by plane. Airline tickets to Houston cost around \$500 per person, but become more expensive the later the team finds out if they can go to Championship, which can happen as late as mid-March. Overall travel expenses (buses, hotels, etc.) become more expensive as the team continues to grow. Neither members nor mentors want to have to

inhibit this growth, so getting more funds is important in the years to come. Funds help with paying the entrance fees for competitions too. Just to compete, the team's first regional costs \$5,000, the second \$4,000, and going to Championship is another \$5,000.

Small donations still go a long way. The team needs money for printing flyers and brochures, buying office supplies, and other smaller items. Donations can also be accumulated over a period of time to help pay for expensive items.

How Many Cupcakes it would take to run Team 3824



Each cupcake represents 6,000 cupcakes, making the total of cupcakes needed to be sold 112,667. A cupcake would be sold for about \$1.40.

Sponsoring the Team

There are six levels of sponsorship depending the amount given to the team. The numbers given below are the least amount given up until the next level:

1. Hawk- \$100
 - Logo on one RoHAWKtics t-shirt
2. Hawk Family- \$150
 - Logo on two t-shirts
3. Copper- \$500
 - Logo on team website
4. Cobalt- \$1,000
 - Logo on t-shirts and website
5. Carbon Fiber- \$2,000
 - Logo on robot, t-shirts, and website
6. Titanium- \$5,000
 - Company name announced at competition along with logo on robot, t-shirts, and website

Other sponsorship opportunities, like t-shirts shot out of NightHAWK and logo on the team's pit at competition, are available at the discretion of the lead team mentors.

IX. Financial Projections

Historical Financial Data

Below is the HVA RoHAWKtics' financial statement for the 2016 competition season, which includes the amount of funds gained from each sponsor, donations, team fees, and left-over from previous years, along with how they are allocated. There is a section for non-monetary donations too. About 51% of the team's income comes from sponsors, while 32% comes from team fees. As far as expenditures go, 87% of the money goes towards paying competition expenses, that of which includes entry fees, buses, hotel rooms, and team meals. The actual production of the robot only accounts for about 9% of the team's expenditures. Other items, such as marketing and miscellaneous, make-up 5%.

INCOME	
Sponsors:	
Bechtel	\$10,000
DowAksa	\$5,000
ASME E.T.	\$200
Soccer Taco	\$500
Tennessee Valley Authority	\$4,500
UT Battelle/ ORNL	\$1,500
Phillips & Jordan, Inc.	\$500
Boeing	\$500
Sharpe Outdoor Media, LLC	\$500
Consolidated Nuclear System	\$2,000
Ingenutec, Inc.	\$1,000
TN <i>FIRST</i> (Alcoa)	\$962
Knox County Science	\$8,000
Knox County Schools	\$5,000
Thomas Weems Architect	\$150
The Kendall Group	\$500
Magnum Venus Products	\$2,000
Oak Ridge/Knoxville Chapter of the American Nuclear Society	\$500
Donations:	
	\$635
Team Fees:	
	\$27,000
Left Over from 2015 Competition Season:	
	\$14,000
Total:	\$84,947
EXPENDITURES	
Competition:	
Entry Fees:	
Palmetto Regional	\$5,000
Smoky Mountain Regional	\$4,000
<i>FIRST</i> Championship	\$5,000
Bus:	
Palmetto Regional	\$5,200
<i>FIRST</i> Championship	\$5,500
Hotel:	
Palmetto Regional	\$19,000
<i>FIRST</i> Championship	\$22,000
Team Meals:	
Palmetto Regional	\$2,000
Smoky Mountain Regional	\$1,600

Robot Production:	
Robot 1	\$2,000
Robot 2	\$5,000
Marketing:	
Stand-Up Signs	\$400
Uniforms	\$1,500
Miscellaneous:	
Office Supplies	\$360
Scouting Tablets	\$1,500
Total:	\$80,060

NON-MONETARY DONATIONS	
Strongwell	Pultruded Material
Team Parents	Saturday Lunches
ORNL	Facilities, Machinery, and Tools
Midlab, Inc.	Brochure Printing

Financial Objectives

The main objectives include:

- Involving students more in fundraising through the implementation of student-made pitches to be given to local businesses
- Keeping a written budget for each year and archive them for future reference
- Raising enough money to keep up the growth of the team
- Continuing the Dignitary Day and other sponsor-communication tactics

X. Contact Information

Main Ways of Contact

Email: rohawktics@gmail.com

Website: rohawktics.org

Social Media

Twitter: @RoHAWKtics3824

Facebook: @rohawktics

Instagram: @hvarohawktics3824

Youtube: HVA RoHAWKtics 3824