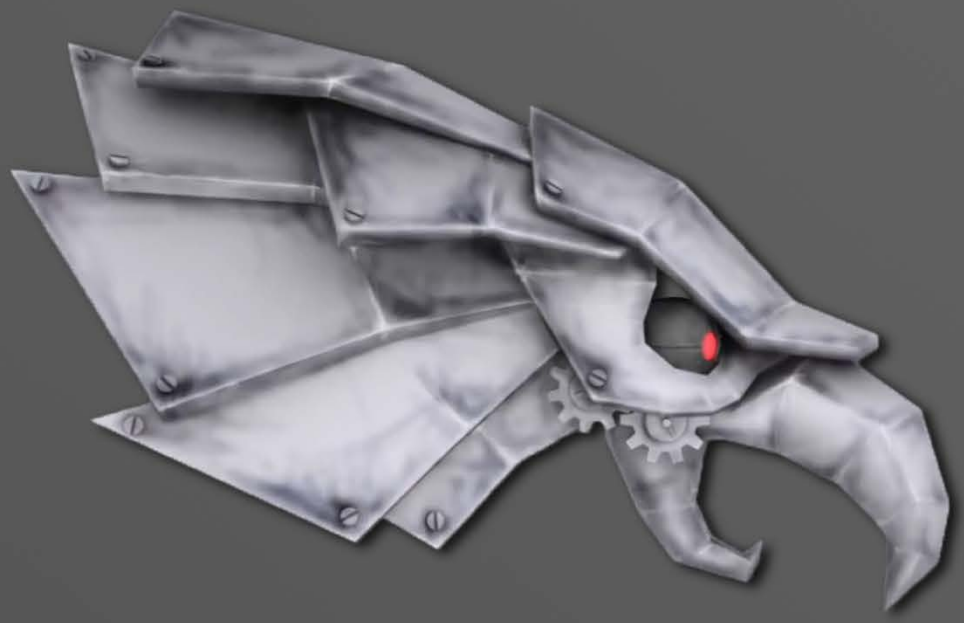

EAGLE ROBOTICS

MOUNT PARAN CHRISTIAN SCHOOL

BUSINESS PLAN 2019-2020

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EXECUTIVE SUMMARY

A Brief Overview

Eagle Robotics is a diverse group of students, grades 9-12, with a unified desire to develop their God-given talents and abilities in Science, Technology, Engineering, and Mathematics, while honoring Him with a balance of professionalism, service, and infectious joviality.

Program and Team Introductions

Eagle Robotics is the *FIRST*® (For Inspiration and Recognition of Science and Technology) robotics program at Mount Paran Christian School.

Students learn STEM skills, teamwork solutions, and much more through competitive robotics.

Originally founded in 2003, Eagle Robotics now consists of over 85 participants. Eagle Robotics programs include:

- Two *FIRST*® Tech Challenge (FTC) teams
- Four *FIRST*® LEGO League (FLL) teams
- Four *FIRST*® LEGO League Jr. (FLL, Jr.) teams

Team 11364 Diamond Plate

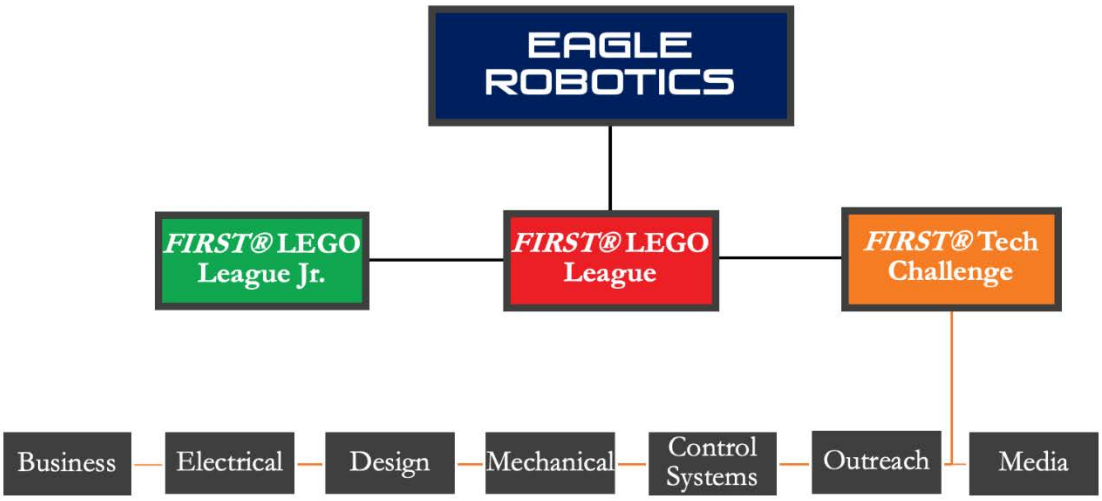
- High school *FIRST*® Tech Challenge team comprised of first-time members.
- Gains problem-solving, teamwork, and essential STEM skills.
- Focuses on building a robot and creating an engineering notebook

Team 7373 Carbon Fiber

- High school *FIRST*® Tech Challenge team comprised of experienced members
- Mentors the younger members of the program
- Exhibits the most developed level of STEM skills

Organizational Structure of Eagle Robotics

Eagle Robotics includes competitive FLL Jr., FLL, and FTC teams. Members in the FTC level have a wide variety of roles available for the season, including (but not limited to) business, design, and outreach.



Recent Competitive Success

2018-19 Season

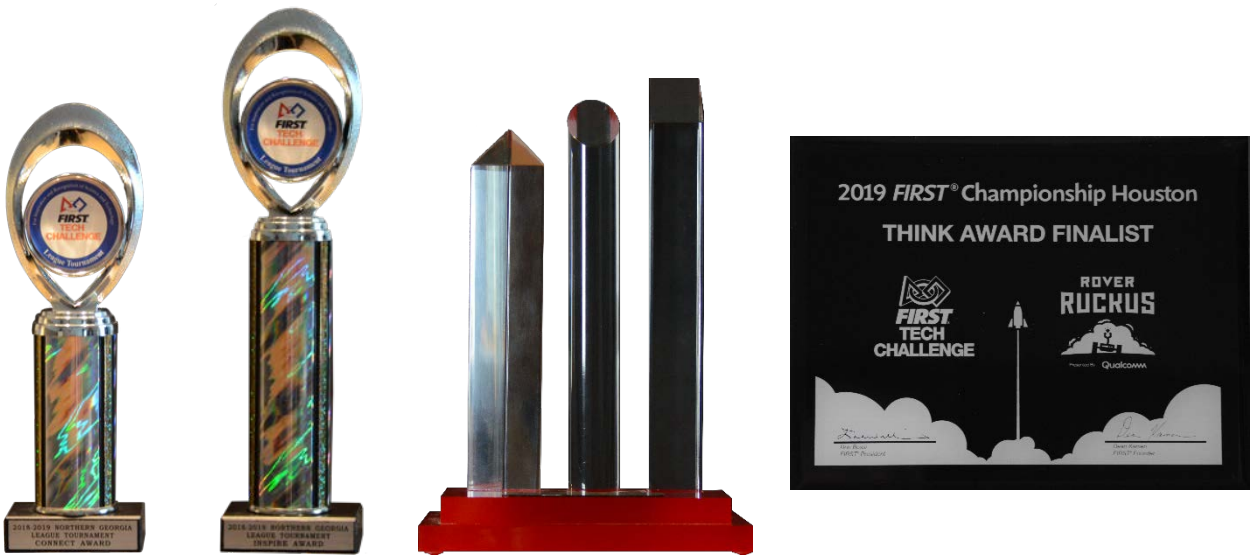
- **Houston World Championship Think Award Finalist (Team 11364)**
- State Championship Inspire Award Third Place (Team 11364)
- State Championship Think Award (Team 11364)
- Northern Georgia League Tournament Inspire Award (Team 11364)
- Northern Georgia League Tournament 2nd Place Inspire Award (Team 7373)
- Northern Georgia League Tournament Connect Award (Team 7373)

2017-18 Season

- State Championship Rockwell Collins Innovate Award (Team 7373)
- State Championship Semi-Finalist (Team 11364 & Team 7373)
- Etowah League Tournament Inspire Award (Team 11364)
- Etowah League Tournament Winning Alliance (Team 7373)
- Etowah League Tournament Control Award (Team 7373)

2016-17 Season

- Super-Regional Championship Competitor (Team 7373)
- State Championship Think Award (Team 7373)
- State Championship Competitor (Team 11364)
- Second Qualifier Inspire Award (Team 11364)
- First Qualifier Inspire Award (Team 7373)



TEAM SUMMARY

MEET THE TEAMS

"Mount Paran Christian School is a place where faith and intellect grow as one. Our robotics program embraces the unique creation God has designed each student to be and fosters their curiosity, resilience, and creativity to better our community and the world. Our high school robotics students routinely give back to our school community by mentoring younger students, and with their support, the middle school program has increased exponentially the past two years. The opportunity afforded to our students to work with industry experts, learn skill sets for the work force, and craft a level of expertise before entering college is a unique gift and a blessing."

- Tawanna Rusk

High School Head of Mount Paran Christian School

TEAM HISTORY

In 2003, the late Professor R. Glenn Allen (Southern Polytechnic State University Mechanical Engineering) invited Mount Paran Christian School STEM Coordinator Brad Smith to the inaugural year of the Georgia hub of the organization called Boosting Engineering, Science, and Technology (*BEST*).

SPSU helps science department offer robotics course

By Todd Muse

This semester, the upper school science department has created a robotics class as an elective for eighth graders. The class is taught by Mr. Brad Smith in conjunction with Southern Polytechnic State University. The class provides a chance for students to participate in a subject that is rare in most schools, public or private. According to Mr. Smith, the class will be a challenge for eighth graders. The students who are participating were chosen for their excellent performance in both math and science.

"Southern Poly Tech approached us with this project and provided the equipment," said Mr. Smith. The class has a contact at SPSU, Dr. R. Glenn Allen, a professor in SPSU's engineering department, who also has children attending Mt. Paran. Occasionally, he comes to speak to the students and acts as an advisor. In addition, students will take two field trips to SPSU where they will get first-hand experience using what they have learned.

The equipment used in class is the Rhino Robot Model XR-4 with a Mark IV Controller, both manufactured by Rhino Robotics Ltd. The XR-4 is a five-axis articulated robot arm that is controlled with programs entered into the Mark IV. All the equipment is on loan from SPSU at no cost to the school.

"The students are learning to manipulate industrial robots, only on a smaller scale," Mr. Smith said. Currently students are learning to move the robotic arm by designing original task-specific programs.

During the course, students will vie to see who is able to achieve the desired results most efficiently and successfully. Tasks include moving objects, avoiding obstacles, and using different degrees of gentleness. Students may be asked to move something fragile, or poke a hole in something with a pencil.

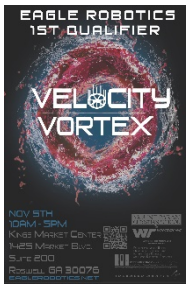
The arm is a complex arrangement of gears, servomotors, bicycle style chains, and a gripper that has multiple attachments for different purposes. It moves, like its human counterpart, on all six planes of motion. However, the arm can only move in a repetitive motion following orders from a program. Since it cannot think for itself or correct itself, the accuracy of the machine depends on the accuracy of the controlling programs which the students design.

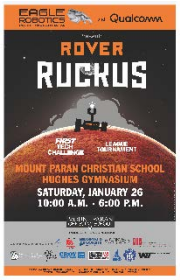
Professor R. Glenn Allen from Southern Polytechnic State University explains to students how a robot (on left) works.

The team gratefully accepted his invitation, and thus Mount Paran's high school competition robotics team was born. Beginning with the *BEST Fever* game, the team went on to spend ten years playing in the *BEST* league.

In the 2013-14 season, Eagle Robotics made the transition from the *BEST* organization to *FIRST*®. Now a *FIRST*® Tech Challenge participant, Team 7373 Eagle Robotics thrived in the *FIRST*® environment and succeeded greatly both on and off the robotics field.

Following the *RES-Q* game (2015-16), Eagle Robotics accumulated so many members that a new team, Eagle Robotics Team 11364 Diamond Plate, was created. Team 7373 was then rebranded to Eagle Robotics Team 7373 Carbon Fiber to parallel the style of the new team. Adhering to the current structure, Team 11364 is comprised of first-year members focused solely on building a robot and compiling an engineering notebook, and returning, experienced team members operate Team 7373





The Teams Today

The high school Eagle Robotics program currently incorporates two *FIRST*® Tech Challenge teams: Eagle Robotics Team 11364 Diamond Plate and Eagle Robotics Team 7373 Carbon Fiber. In total, there are nearly twenty students. The teams meet three times each week: after school on Tuesdays and Thursdays and from nine to one on Saturdays. Both teams are coached by Brad Smith, Mount Paran STEM Coordinator, and are mentored by John Quarles, an electrical engineer with Lockheed Martin.

Core Values

Core values are the backbone of all *FIRST*® Tech Challenge teams. The priorities, goals, passions, and visions of Eagle Robotics spring directly from its values. The values are embraced by each individual member as well as the corporate whole of the team. These values identify us as a family, a team, and most importantly, as Christian roboticists.

1

At the center of Eagle Robotics are three core values; the first of which, and the most prominent, is "**First Things First.**" This is a statement based on Matthew 6:33, which says:

"***But seek first His kingdom and His righteousness, and all these things will be given to you as well.***"

Therefore, **"First Things First."** declares that God comes before everything else, and when that principle is honored, the entirety of our activities will fall in place according to God's will. One of the ways we incorporate this is by offering up corporate prayer before beginning any meeting or making an important decision.

2

Our second core value is the belief that **the ability to design and manufacture is a gift from God.** This core value is reflected in Exodus 31:1-6:

"God spoke to Moses regarding these men. Moses records God's words as 'I have filled him [Bezalel] with the Spirit of God in wisdom, in understanding, in knowledge, and in all kinds of craftsmanship, to make artistic designs for work in gold, in silver, and in bronze, and in the cutting of stones for settings, and in the carving of wood, ***that he may work in all kinds of craftsmanship.*** *And behold,* ***I Myself have appointed with him*** *Oholiab, the son of Ahisamach, of the tribe of Dan; and in the hearts of all who are skillful I have put skill, that they may make all that I have commanded you.'"*

In the light of the gifts that have been bestowed upon us, we believe it is both a duty and a privilege to hone these skills and exhibit them to the glory of the God that gave them to us.

3

Finally, our third core value acts as a combination of the first two. We recognize that **it's not all about us.** It is both our honor and desire to use the skills God has given us in service to others. Philippians 2:3-4 states:

"***Do nothing out of selfish ambition or vain conceit****. Rather, in humility value others above yourselves, not looking to your own interests but each of you to the interests of the others.*"

The *FIRST*® program seeks to become more than robots by encouraging teams to engage in outreach. This entails going out into the local community to promote STEM. We take this a step further by volunteering our time and providing a Christian motivation behind our outreach.

OUTREACH

Within Mount Paran Christian School, Eagle Robotics has grown outside of *FIRST*® Tech Challenge to incorporate four, tiered middle school *FIRST*® LEGO League teams and a developed robotics program throughout the lower school.

Within this structure, students are able to start young in the *FIRST*® program within the school, and as they move up in grade, they will also advance through the progression of *FIRST*®. **This cycle creates a self-sustaining STEM pipeline.** The ultimate goal of this is to enhance the school STEM culture by providing a wider opportunity for students of all ages to explore STEM as a life skill.

As we have in previous seasons, we will continue to regularly invest our time and resources into Mount Paran's *FIRST*® LEGO League teams, serving as mentors by helping with robot design and team presentations. In addition, we will continue to offer regular use of our competition field space for local teams who do not have access to the same resources.

Outreach Statement

"Outreach at Eagle Robotics is an active, collective effort made to express our core values through giving back to the surrounding community, including other FIRST® teams, Mount Paran, and the local Kennesaw-Marietta area."

We also recognize that outreach should extend beyond our school campus. Therefore, we dedicate time to investing in our community within and outside of robotics. We do this in the hopes of establishing long-lasting, mutual relationships with all who surround us. Eagle Robotics is developing an **action plan** for the upcoming season to outline our strategic goals for impactful outreach events.

Member Activities and Mentor Opportunities

Members of Eagle Robotics are provided with the opportunities to specialize in the following aspects of team activities: business, media, electrical, design, mechanical, and control systems. Adult instruction positions are also available to help guide students in these areas.

Business

- Business Plan
- Bill of Materials
- Budgeting and accounting
- Fundraising (organization of events, solicitation, documentation of income)
- Purchasing and billing
- Branding and marketing strategy
- Coordinating pit booth printing, poster and flyer distribution, and other needed outsourcing for graphics work

Electrical

- Providing electrical schematic drawings
- Electrical hardware and solutions
- Electrical connection, soldering, wiring (routing), harnesses, and labeling
- Battery maintenance and charging
- Testing electrical components for functional integrity

Design

- CAD all parts prior to manufacture, construction, or assembly
- Maintaining active CAD libraries, revisions, drawings, renderings, and animations
- 3D printer operation and maintenance
- CNC Mill operation and maintenance
- Training for team on 3D printing and CNC mill operation
- Managing archives of CAD from previous years or databases of kits of parts

Mechanical

- Keeping teams tool-safe and developing training protocols
- Making sure tools are organized, maintained, and replenished when broken or worn
- Determining components and parts required for robot build
- Providing dimensioned drawings for CAD team, evidence of proof-of-concept testing, proof of engineering modeling, and evidence of performance testing for the engineering notebook
- Constructing robot

Coach/Mentor

- Communications
- Student service through STEM
- Team safety and training
- Registering for competition events
- Field experiences/plant tours
- Overseeing general sponsor relations
- Moderating media and digital presence
- Fundraising

- Judge & leadership training
- Coordinating volunteers
- Transportation
- Assisting in robot design

Control Systems

- Learning and instructing Java or Blocks Programming
- Software licensing and installation
- Cloud storage management
- Software implementation and team training
- Programming the robot for both Autonomous and Tele-Op modes
- Calibrating and managing sensory equipment
- Coordinating controls with the drive team
- Documenting the code with flowcharts or other logic organizing tools

Outreach

- FLL mentoring (coordinates participation) and service projects
- Hosting or attending scrimmages, and events
- Team relations at competitions (meet and greet, giveaways, scouting documents, and documenting assistance to other teams)
- Organizing trips to visit local engineering businesses
- Heads documentation of all outreach events

Media

- Website
- Web photos and videos
- Group email notices
- Event promotion
- Monthly newsletter
- Coordinating outsourcing for graphics work
- Shirts and wearable gear
- Sponsor logos
- Photography and videography
- Coordinator for team portrait/robot portraits

FIRST® AT-A-GLANCE

HIGHLIGHTS OF *FIRST®*

"FIRST® has provided me with the experience and knowledge for my future in a way that no other class or organization could."

- Aidan Hanson

Sophomore, Member of Eagle Robotics Team 7373 Carbon Fiber

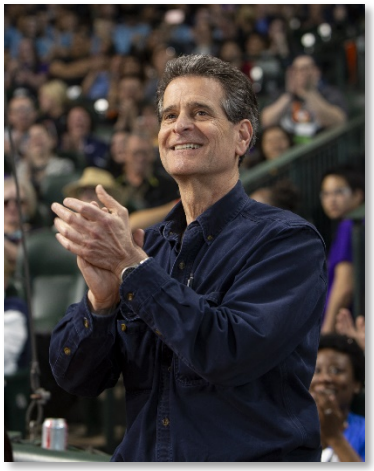
Founded over thirty years ago, *FIRST®* was established with the intent of expanding young people's interest in the STEM field, leading to new relationships, lasting hobbies, and future careers. Adding to this, *FIRST®* also builds on students' knowledge, life skills, and self-confidence.

This is accomplished through engaging students from grades K-12 in challenging, mentor-based research and robotics programs. In each of these robotics programs, teams of students work through not only the process of designing a robot and programming it with instructions but will learn core values and how to present themselves to a judging panel as well.

"FIRST® is more than robots. *The robots are a vehicle for students to learn important life skills. Kids often come in not knowing what to expect – of the program nor of themselves. They leave, even after the first season, with a vision, with confidence, and with a sense that they can create their own future."*

- Dean Kamen

Founder of FIRST®



FIRST® Progression of Programs

FIRST® encompasses four programs designed to provide STEM experiences for all different levels and age groups. Our teams compete in the *FIRST*® Tech Challenge program.

Progression of Programs Overview

	FIRST	FIRST LEGO League Jr.	FIRST LEGO League	FIRST Tech Challenge	FIRST Robotics Competition
Overview	Guided by adult Coaches and Core Values, teams design and build a Team Model based on the Challenge, using LEGO® Education WeDo to program it to move. They illustrate their research and journey in a *Show Me* Poster, sharing what they learned.	Teams design their own solution to a real-world problem and build autonomous LEGO® MINDSTORMS® robots that perform a series of missions based on an annual theme.	Teams design, build, and program their robots to compete in an Alliance format against other teams. Robots are built from a reusable platform, powered by Android technology, and programmed using Java or Blocks.	Teams of students build and program a robot to perform prescribed tasks against a field of competitors, and are challenged to design a team "brand," and hone teamwork skills.
Season Information	**Registration Open:** May – April **Challenge Release:** August **Event/Tournament Season:** August – April	**Registration Open:** May – Sept. **Challenge Release:** August **Event/Tournament Season:** November – April	**Registration Open:** May – March **Game Release:** September **Event/Tournament Season:** November – April	**Registration Open:** May – Dec. **Game Release:** January **Event/Tournament Season:** February – April
Grades & Ages	Grades K-4; Ages 6-10	Grades 4-8; Ages 9-16 *(Ages vary by country)*	Grades 7-12; Ages 12-18	Grades 9-12; Ages 14-18
Team Composition	**Teams of 2-6 children** formed by schools, after school programs, home schools, community groups.	**Teams of up to 10 students** formed by schools, after school programs, home schools, community groups.	**Teams of up to 15 students** formed by schools, after school programs, home schools, community groups.	**Teams of 10 or more students** formed by schools, after school programs, home schools, community groups.
Time Commitment	One-to-two hour meetings, generally held for 8-12 weeks	One-to-three-hour meetings, generally held for 8-12 weeks	Two-to-four hour meetings, generally held twice a week for 8-12 weeks	Six week build season from January-February
Estimated Program Costs	**Single Team Registration –** $99 **WeDo 2.0** - $167.95 (reusable) **Season Pass, Small** (12 teams) –$895 **Season Pass, Large** (24 teams) – $1,750	**Single Team Registration –** $225 **Robot Kit –** $469.95 (reusable) **Challenge Set –** $75 (annual) **Season Pass, Small** (up to 50 students, one competitive team) - $950 **Season Pass, Large** (up to 100 students, one competitive team) – $1,795	**Team Registration –** $275 **Robot Kit of Parts –** $995 (reusable)	**Team Registration & Materials –** $6,000 (new teams) $5,000 (existing teams)
Scholarships & Grants	Grants may be available. Check our website for offerings.	Grants may be available. Check our website for offerings.	$50 million in scholarships from nearly 200 Providers.	$50 million in scholarships from nearly 200 Providers.

FIRST® Tech Challenge Highlights

Team Structure and Activities

- Teams consist of a maximum of 15 students, with 2-3 adult mentors per team.
- *FIRST*® Tech Challenge students are ages from 12 to 18 years
- Team members engage in robot construction, engineering, programming, and event competition

Events

- 6,800 *FIRST*® Tech Challenge teams during the 2018-19 season with 68,000 total participants representing 37 countries
- Consist of practice league meets and ranked league tournaments
- Have accumulated over 18 million volunteer hours between all levels since 1989

- Fast-paced competition that offers opportunities to connect with other robotics students from different backgrounds

The Game

- Each new season, *FIRST®* releases a robot challenge for each of its levels
- The 2019-20 game for *FIRST®* Tech Challenge is *Skystone*

The Field

- The field area is 12' x 12'
- Main activity area for robot competition
- 4 robots from 2 alliances contend during a match

The Robot

- Maximum dimensions of 18" x 18" x 18" with a maximum weight of 42lbs
- Must accomplish a variety of tasks to score points
- Robots are built from scratch using a modular kit of parts
- Powered by Android technology using industry-standard programming languages and machine learning technology
- Components include motors, servos, sensors, electronics, and aluminum extrusion

The Awards

- **Inspire Award**
  - Presented to the team that exemplifies the spirit of the *FIRST®* Tech Challenge
- **Think Award**
  - Given to the team that best navigates the engineering design process
- **Connect Award**
  - Awarded to the team that connected most to the local and engineering community
- **Rockwell Collins Innovate Award**
  - Presented to the team with the most inventive design
- **Design Award**
  - Awarded to the team that connected most to the local and engineering community
- **Motivate Award**
  - Stands for outstanding team spirit and enthusiasm
- **Control Award**
  - Acknowledges the team that best utilizes sensors and software
- **Promote Award**
  - Challenges teams to submit a high quality, 60-second PSA video based on an annual theme
- **Compass Award**
  - Requires teams to submit a video nominating an exceptional coach or mentor
- **Winning Alliance Award**
  - Earned by the alliance that wins the final elimination matches
- **Finalist Alliance Award**
  - Acquired by the alliances in the final match of the entire competition

FINANCES

The Business Side

Program Vision Statement

"Eagle Robotics will become the nexus in which healthy competitive spirit and STEM education converge. Eagle Robotics seeks to become the model FIRST® program in Georgia, defined by competitive rigor and sustained excellence in leadership and engineering."

Why Sponsor Us?

Eagle Robotics aspires to be the crossroads at which competitive spirit and STEM education meet. Not only do we aim to be a strong competitor, but it is our greater concern to work towards providing proper leadership and a connected learning environment to those within our reach.

For many years, we have gained experience in areas such as 3D printing and CAD modeling, robotics, working with real materials, interacting with companies in a professional manner, and leading with initiative and dependability.

These skills are constantly being taught to students by coaches, mentors, other students, and sponsors. Many students have been able to pursue engineering jobs and internships due to their experiences in this program. These opportunities to teach and learn are made possible through sponsors and donors of our program. By investing your time, knowledge, and/or finances, you are helping raise the next generation of STEM students that will change our world, and for that, we are most grateful.

Sponsorships

Sponsor tiers are based on the monetary amount donated. **Each tier receives unique benefits and also receives the benefits of the tier below it.** Eagle Robotics respects that sponsors may wish to opt out of certain benefits or remain anonymous.

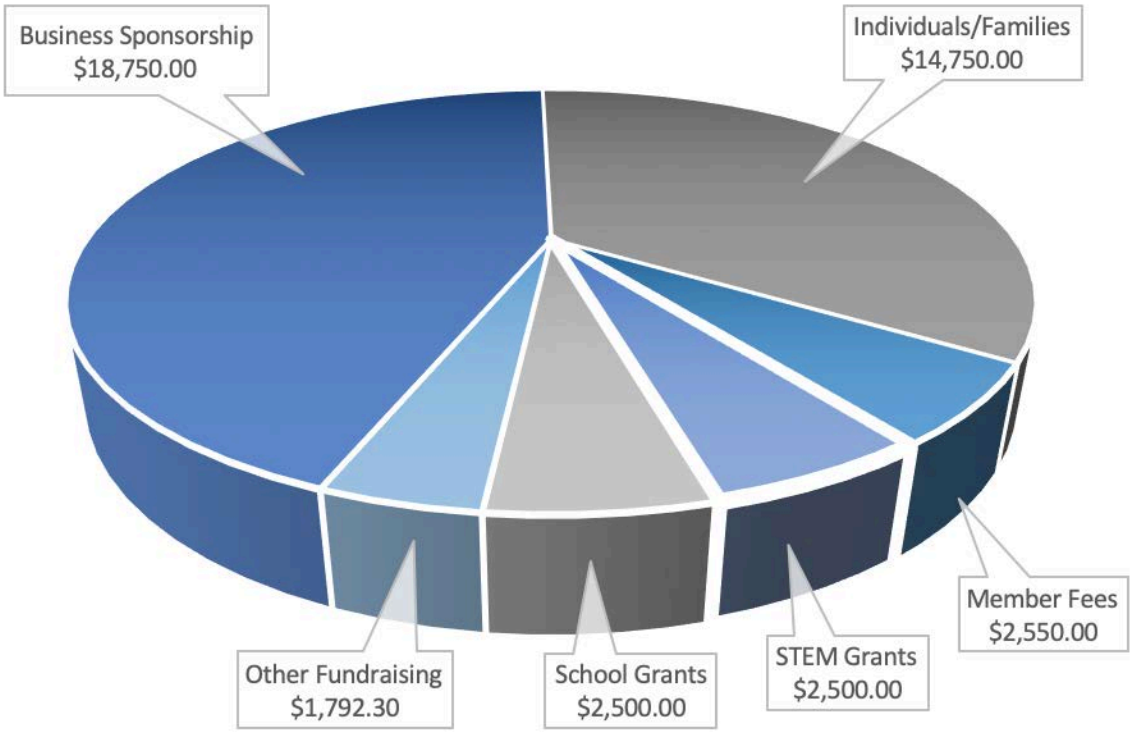
We strive to build ongoing, strong relationships with our sponsors, and we are grateful for their contributions. Our team welcomes interaction regarding any question, contribution, tour, or opportunity you might be able to provide (see p. 18 for contact information).

Sponsor Benefits

- **Platinum Sponsors (≥ $1000)**
  - Logo or name on robot
  - Custom sponsor plaque
- **Gold Sponsors ($999-$500)**
  - Logo or name on team print collateral
- **Silver Sponsors ($499-$250)**
  - Logo or name on themed t-shirt
  - Recognition in monthly newsletter
- **Eagle Sponsors ($249-$1)**
  - Logo or name on website

Revenue Streams From 2018-19

The revenue streams of Eagle Robotics from the 2018-2019 season are depicted below.



EXPENDITURES FROM 2018-19

These are the expenses from the previous season of Eagle Robotics. Team 11364 advanced to the World Championship in Houston, Texas, adding extra expenses beyond the State Championship.

Expenditures	
Events & Fees (Including World Championship)	$14,913.60
Robot Parts, Robot Tools, & Equipment	$10,595.20
Uniforms	$4,479.20
Transportation (Including World Championship)	$4,033.68
Tournament Hosting	$3,857.21
Marketing	$1,909.96
Team Management	$179.65
Engineering Notebooks	$110.16
Total:	**$40,078.66**

PROJECTED BUDGET FOR 2019-20

This budget is based on the previous season's expenditures and will cover the operation costs of two *FIRST*® Tech Challenge teams from the season start through state competition, accounting for robot parts, marketing, events, and more. If a team advances to the Houston World Championship, additional funding will be needed in order for them to compete.

Expenditures	
Robot Parts, Robot Tools, & Equipment	$11,000.00
Tournament Hosting	$5,000.00
Marketing	$2,000.00
Events & Fees	$1,650.00
Uniforms	$900.00
Transportation	$700.00
Engineering Notebooks	$275.00
Total:	**$21,525.00**

*If a team advances to the Houston World Championship, additional funding will be needed (estimated $19,000).

MEDIA AND TEAM CONTACT INFO

MEDIA

Eagle Robotics Website: eaglerobotics.net

Eagle Robotics YouTube Channel: Eagle Robotics

***FIRST®*:** firstinspires.org

Georgia *FIRST®* Robotics: gafirst.org

TEAM, COACH, AND MENTOR

Team Emails:

Team 7373: team7373robotics@gmail.com

Team 11364: team11364robotics@gmail.com

Brad Smith: Head Coach

Email: bsmith@mtparanschool.com

John Quarles: Lead Engineering Mentor

Email: jgquarles1957@gmail.com

Mount Paran Christian School

Mount Paran Christian School

Attn: Brad Smith

1275 Stanley Road NW

Kennesaw, GA 30152

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