

1.0 EXECUTIVE SUMMARY

1.1 Mission Statement

The mission of Miracles of Engineering (MOE) 365 FIRST® Tech Challenge (FTC) is to:

- Proudly represent ourselves and our partner organizations by exhibiting FIRST values of Gracious Professionalism and sportsmanship at all times.
- Inspire children of all backgrounds to pursue STEM careers by sharing passion and opportunities through community outreach.
- Strengthen youth and professional STEM communities through collaborations and partnerships.
- Build a cohesive team based on the respect, communication, creativity, and commitment of all members.
- Develop student skills of leadership, professionalism, responsibility, and teamwork.

1.2 FIRST Description

The FIRST program strives to inspire young people so they can become leaders in the scientific and technological industry, immersing them in stimulating programs led by mentors that build STEM skills, inspire innovation, and grow life capabilities including self-confidence, communication, and leadership.

Originally, FIRST was founded in 1989 in Manchester, New Hampshire, so young people could be inspired to participate in science and technology related activities. Classified as a 501(c)(3), FIRST is a nonprofit public charity that aids in designing accessible and innovative programs motivating young people to seek out opportunities in the STEM field while also building important life skills.

1.3 FIRST Tech Challenge Description

The FIRST Tech Challenge consists of teams of up to 15 team members from grades 7-12 competing in a head to head and alliance configuration. This year, FIRST Tech Challenge teams have adapted a virtual competition platform to ensure safety through the season. These teams are challenged to program, design, build, and operate robots alongside adult coaches and mentors. Not only do students develop STEM skills and practice engineering principles, they are also taught the importance of hard work, innovation, and sharing ideas. The robot kit is reusable

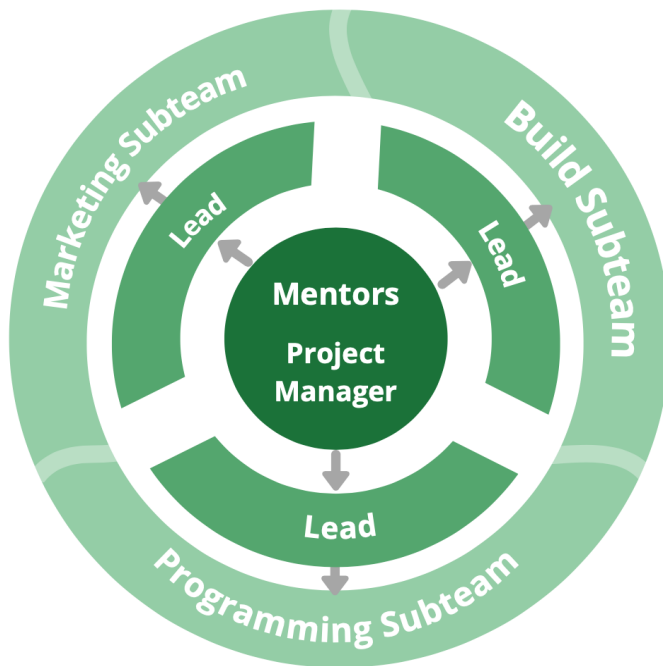
every year and is programmed using many different programming languages. Teams are also required to raise funds, design and market their team brand, and promote community outreach.

1.4 Team Summary

MOE 365 FTC is a community team based in Wilmington, Delaware. The team designs, builds, and programs robots to participate in competitions released annually by FIRST. MOE 365 has proudly competed at the FIRST World Championship five times. The team aims to use its creations to inspire those in the local and global community to become more involved in STEM and develop new skills and passions.

1.5 Team Structure

MOE's team structure is best summarized in the chart below.



MOE's team structure is based on the foundations of responsibility, leadership, communication, and learning. All team members are encouraged to take initiative and ownership over their assigned tasks, and general subteams operate under the supervision of both mentors and student leaders to allow for the development of real world skills including goal setting, task delegation, disciplined work ethic, and teamwork.

The team is largely dependent on the volunteer efforts given by coaches and mentors of varying technical and non-technical backgrounds. These personnel manage the team's administrative operations and work directly with team members to provide guidance and offer advice on various tasks.

The project manager is a role taken on by a team member that includes the responsibility of scheduling deadlines, overseeing each subteam, and assigning tasks. This team member should possess organizational and management skills in order to work closely with mentors and all subteam leads.

Individual subteam leads include the Design/Build Lead, Programming Lead, and Marketing Lead. These roles are undertaken by team members who have the experience and leadership qualities necessary to supervise their peers in performing various team functions, both technical and non-technical. These are critical roles that allow for efficient communication between subteams and productive task completion.

Individual team members make up the foundation of each subteam. These are nonrigid roles that allow for skill development in multiple areas under the guidance of subteam leads and mentors. New team members typically assume this position in the first year of participation, and all team members have the option to try new subteams to encourage personal growth.

2.0 TEAM IMPACT

2.1 Objectives

One of MOE's core purposes is to spread passion and knowledge of STEM to the local community, fellow FIRST teams, and across the world. The importance of giving back is emphasized just as highly as any technical team function. The team constantly strives to increase both the number of people reached and the impact of the event or interaction.

This objective is achieved through two major means: a diverse outreach program and a robust marketing campaign.

2.2 Outreach

For the 2021-2022 season, MOE's outreach program aims to expand upon what was achieved last season while maintaining a safe environment for team members and our community.

- MOE typically participates in and organizes 10-15 community events per year. These are fantastic opportunities for team members to interact with those living in the local region who may not have had previous exposure to STEM-based initiatives. Examples include:
 - Gravity Festival at Bellevue Community Center (2017-2019)
 - Harvest Fall Festival (2021)
 - Hagley Maker Fair/Weekend Events (2017-2022)
 - Delaware Children's Museum STEM Fairs (2020)
 - Blue Rocks Games (2018-2021)
- MOE team members maintain an active presence on online communication platforms, especially Instagram, Discord, and the FIRST Tech Challenge Reddit. These online sites allow for mutual idea sharing and collaboration.
- MOE students and mentors are also active on the Delaware FTC Discord server, answering questions, promoting events, and exchanging advice with local teams.
- MOE frequently meets or corresponds with fellow FTC teams. The team strives to form constructive, long-term relationships with other teams, such as through events like the XEO Challenge.

2.3 Marketing

MOE believes that building a brand and increasing online presence will help the team spread its message and reach more people.

- Using the tool newsletter builder MailChimp, team members have released a monthly newsletter during the months of the active season since 2020. It is called STEM in MOEtion and discuss topics including:
 - Videos: Day In the Life of a MOE Student, Robot Reveal Trailer
 - FTC Team Spotlight: introducing other teams that we have collaborated with
 - MOEdern Innovations: discusses new STEM news articles and inventions
 - CoMOEly Break: a fun platform for team members to share comics
 - MOEblog: an opportunity for team members to share their MOE experiences
 - Get MOEving: Summer opportunities and STEM programs for youth.
 - Team updates and upcoming event schedule

- MOE also uses social media as a part of its marketing campaign. Using Instagram, Twitter, and Facebook accounts, the team posts approximately 6 times per month with photos, announcements, and videos from practices or outreaches.

3.0 CONNECTIONS AND SPONSORS

3.1 Overview

MOE seeks to form long lasting, mutually-beneficial relationships with individuals, companies, and other teams, both locally and globally.

3.2 Partners

- **Hagley Museum** - For many years, MOE has attended events at Hagley. This connection was expanded this year as MOE students created a summer camp lesson and had frequent contact via email with the STEAM Education Program Coordinator at Hagley.
- **Archmere Academy** - Mostly through student connections, MOE has established a partnership with Archmere's FTC team, #395 Rob-AUK-tics, and has worked with them to hold events like Kickoff and meets at the school.

3.3 Sponsors

MOE is financially dependent on the contributions of generous sponsor organizations. However, the team aims for these relationships to be more than sources of funding. Instead, MOE is dedicated to actively giving back, communicating, and sustaining its sponsors from season to season.

MOE's sponsors for the 2021-2022 season are:

- **REV Robotics** - (new) REV offers an annual sponsorship opportunity for approximately 50 FTC teams. This year, MOE was proud to be selected for a contribution of \$250 in store credit. The team frequently uses REV mechanical and electric parts and hopes to develop a closer relationship with this company.
- **Arconic Foundation** - (new) Arconic is a manufacturing organization that provides innovative architectural products that advance the industrial and technological markets.

This year, Arconic provided financial support through an FTC-specific grant that MOE applied for.

- **NAI Emory Hill** - starting in the 2020-2021 season, NAI Emory Hill gave MOE access to a large conference space to allow for socially-distanced meetings. We sustained this connection this year and used the space for our judging presentation.
- **Labware** - MOE has been in contact with Labware's founder, Vance Kershner, for multiple years. This year, the company graciously donated \$5,000. MOE students communicate through emails and have organized robot demonstrations at company events.
- **DuPont/ Corteva** - MOE has built a successful long-term relationship with DuPont. The company provides the team with the invaluable resources of a lab space, a conference room, and access to machinery and equipment. This connection is mostly managed through MOE's parent organization, FSR, and MOE contributes by providing periodical updates on how they use the facilities.
- **Boeing** - MOE has created a long-term connection with Boeing after multiple years of support in the form of finances as well as multiple mentors. To give back for Boeing's continued contribution, the team has created demonstration events for the company.
- **First State Robotics** - First State Robotics is the parent organization of MOE. They are a nonprofit organization that aims to foster students' interest in science and technology. During this season, they have assisted MOE with fundraising projects.

4.0 S.W.O.T. ANALYSIS

4.1 Overview

MOE 365 understands that capitalizing on strengths and opportunities while counterbalancing weaknesses and threats is critical to improving how the team functions and performs. It is for this reason that the team places an emphasis on introspection and thoughtful planning both as individuals and as a team unit. MOE 365 aspires to not only recognize its strengths, weaknesses, opportunities, and threats, but to take deliberate actions based on these factors in order to create constructive, long-term benefits for the team. MOE held a full-team SWOT analysis discussion, led by the student project manager, and the conversation is summarized below.

4.2 Strengths

Team strengths include:

- Community Partnerships - MOE has several existing relationships with local schools and organizations, including Hagley Museum and Serviam Girls Academy, where MOE has organized and attended multiple events in the past.
- Human Resources - MOE has a large roster of thirteen student team members. The team hopes to use this large roster to maximize its production, attention to detail, and impact on the community.
- Mentor Support - MOE is proud to have the help of many experienced mentors with different areas of expertise as well as several parents and siblings of team members.
- Sponsors - MOE benefits from multiple legacy sponsors who provide crucial support to the team. These contributions allow for the team to have the finances required for travel, mechanical parts, spirit gear, and more. Additionally, MOE benefits from lab space courtesy of DuPont and a new conference room courtesy of NAI Emory Hill Real Estate.
- Programming - As a specific technical operation, MOE holds great confidence in the work of its team of student programmers. The programming subteam has shown consistently high performance in the past, including being nominated for the Control Award at the 2019 FIRST World Championships. The team keeps this factor in mind when making decisions and setting priorities.

4.3 Weaknesses

Team weaknesses include:

- Recruiting - In past years, MOE has mostly attracted new students to join the team through existing family and friend connections. This motivated the team to create a more robust application system.
- Professional Connection Opportunities - Expansion in new connections became increasingly difficult with the COVID-19 pandemic, so the team wants to develop new professional and industry relationships to find new mentorship opportunities.
- Time Management - Despite a notable improvement in time management last season, building two robots created significant time pressure towards the end of the year. This is something to be improved during this 2021-2022 season.

4.4 Opportunities

Team opportunities include:

- Skill Building - In past seasons, students mostly worked within their own subteams. This year, we want to create increased opportunities for learning opportunities between subteams.
- Team Bonding - Especially following a mostly virtual season, MOE wants to create more collaboration and fun at meetings.
- New Members - This year, MOE has a large number of new members and members who were new last year. Through subteam guides and working with experienced members, the team can train new members to learn CAD, documentation, programming, and more.
- Documentation - Last season's pandemic season meant that documentation was less disciplined. This year, the team plans to re-implement regular notebook entries.

4.5 Threats

Team threats include:

- Team Graduates - MOE's student build/design lead is a current senior. Because of this, MOE aims to place a heightened emphasis on developing both mechanical skills and leadership abilities among its younger members so that the team will be able to transition seamlessly into the 2022-2023 season.
- DE FTC Sustainability - Unfortunately, some DE FTC teams were unable to compete last season due to the pandemic and there are not many local teams.

5.0 TEAM GOALS

5.1. Overview

MOE 365 uses goals to define its annual objectives, focuses for the season, and team workflow. In order to set effective goals, the team sticks to the principle of SMART goals, or Specific, Measurable, Attainable, Relevant, and Timebound.

- Specific: The goal should be descriptive and clear in regard to exactly what should be achieved as well as the reasoning behind creating this goal. Knowing exactly what the goal entails will increase the chance of success.
- Measurable: This criterion ensures that the completion of the goal will be recognized using elements or resources that can be measured objectively. This allows the achiever to actively document and report progress with concrete evidence.

- Attainable: The goal should be proportional to the amount of time and effort the goal setter is willing to commit. If the available time does not account for what the goal is asking for, then it will be impossible to achieve. This step helps in weighing the costs and benefits to ensure that the goal is both realistic and constructive.
- Relevant: The goal must be related to an area that requires improvement. Addressing the relevance behind the goal, or why the goal is being achieved, will help motivate the achiever to complete and feel a sense of ownership over the task.
- Timebound: Instilling deadlines in a realistic and flexible manner will ease the process in achieving the goal. Planning with time limits can help the goals turn into a reality by inducing action.

5.2 Season Goals

MOE's goals for the 2021-2022 FREIGHT FRENZY season are:

- Community Partnerships: Strengthen existing connections with Hagley Museum and Serviam Academy through 2+ events at each.
- Outreach: Send one newsletter (STEM in MOEtion) edition every month and have all students contribute to 1+ sections.
- Recruiting: Proactively market our team to new students creating and distributing flyers and an application form to local schools and organizations.
- Professional Connections: Find new mentors and learning opportunities in industry through a CAD review and a lab tour.
- Team Bonding: Create fun and friendship by holding team bonding activities at meetings every month.
- DE FTC Sustainability: Support long-term sustainability of DE FTC by starting a new team.
- Graduating Mechanical Lead: Develop a CAD curriculum to transfer skills to younger students.

6.0 SUSTAINABILITY

6.1 Future Plans

MOE 365 takes pride in its actions. In order to ensure continuous sustainability, the team plans to expand further in its work both in the FIRST program and out in the community.

- MOE 365 is dedicated to building long term relationships with the sponsors by actively engaging them through the season. The team has strengthened these relationships by participating in employee demonstrations and events at Labware, Boeing, and DuPont as well as displaying their logos on the robot and team shirts. The team plans to continue to represent the sponsors and participate in events related to sponsors in order to show appreciation for all they have done for MOE.
- Along with the team's priority of communicating the importance of STEM, MOE 365 is a team that is helpful and resourceful to the FIRST community. This ranges from providing information for newer teams so they can take their first step to brainstorming ideas virtually for the season with other teams, and it is an important characteristic for the team to develop and expand upon.

6.2 Human Resources and Recruitment

MOE's team members, coaches, and mentors are the essential components that allow the team to function. Therefore, great team effort is dedicated to the continued recruitment and training of these personnel.

- For the 2021-2022 season, MOE students led a process of creating an information sheet and application to distribute to local schools, organizations, and clubs in order to attract students beyond existing family and friend connections. This was very successful, as MOE received 13 applicants from 6 schools and was even able to connect applicants together and start a new FTC team.
- MOE attracts new coaches and mentors primarily through connecting with coworkers, peers, and friends. In addition, alumni members and parents also provide support and advice to the team.

- MOE ensures that new members are benefiting from prior team knowledge by pairing them with more experienced team members and subteam leads who can instruct and guide them through the continuous learning process.
- MOE does not believe that any prior technical knowledge is necessary to excel as a FIRST Tech Challenge participant. The team welcomes students and mentors of all backgrounds, regardless of ability or experience.

6.3 Individual Development Plans

New for the 2021-2022 season, MOE mentors and the project manager held meetings with each student to fill out an individual development plan. It included the following information:

- Team expectations and discussion about what commitment the student can make
- Non-technical goals and outreach planning
- Technical skill building and goals
- Future role planning
- Student responsibilities

In addition, check in meetings were held with students throughout the season. This helped us assign students to projects they were interested in, create skill building exercises individual to each student, and help younger students see their future role on the team.

7.0 FINANCES

7.1 Overview

MOE understands the importance of teaching students about financial management and fundraising. While the team finances are primarily handled by mentors, students get involved by sitting in on periodical review meetings, documenting mechanical parts to be ordered, and contacting potential and existing sponsors.

MOE's budget consists primarily of sponsor contributions and a carry over fund that transfers from year to year. MOE's expenses consist primarily of registration fees, mechanical costs, spirit gear, and outreach materials.

7.2 Income

MOE 365 FTC Income	2020-2021 Estimated
Sponsors	
Boeing	\$275
LabWare	\$5,000
Arconic Foundation	\$1,000
Miscellaneous	
Students	\$1,800
Boeing Gift Match	\$4,600
Carry Over From Previous Year	\$27,306
Income Total	\$39,981

7.3 Expenses

Estimated Expenses	Estimated
Registration Fees	
FIRST Registration	\$275
DSFTC Registration	\$250
Competition Entry Fees	\$2,000
Parts	
General Parts	\$7,000
REV Robotics: Driver Hub	\$400
FTC Build Kit	\$1,160
Gamepad Controllers (4)	\$180
CNC Router	\$1,500
Team Laptops	\$1,000
Misc.	
Support of New FTC Team	\$2,000
Website/Domain	\$144
Outreach Materials	\$300
End of Year Party / Team Bonding	\$1,000
Spirit Gear - Team Jackets	\$600
Competition Food	\$200
Expense Total	\$18,009

8.0 RESOURCES

8.1 FIRST™ Links

- FIRST Website: <http://www.usfirst.org>
- FIRST Tech Challenge Website: <http://www.usfirst.org/roboticsprograms/ftc>
- FTC in Delaware: <http://www.delawareftc.org>

8.2 Team Links

- Website: <https://moefc.org>
- Instagram: <https://www.instagram.com/miraclesofengineeringftc/>
- YouTube Channel: <https://www.youtube.com/user/moe365ftc>