

# MIRACLES OF ENGINEERING (MOE), #365



## TEAM PLAN 2019-2020

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## **1.0 EXECUTIVE SUMMARY**

### **1.1 Mission Statement**

The mission of Miracles of Engineering (MOE) 365 FIRST® Tech Challenge (FTC) is to proudly represent For Inspiration and Recognition of Science and Technology (FIRST®) in the local and global community by:

- Competing with the utmost sportsmanship to our partners, competitors, and all event personnel.
- Exhibiting the core values of FIRST with respect to “Coopertition” and Gracious Professionalism.
- Encouraging both children and adults to involve themselves in STEM related activities in order to understand the importance of such skills that will increase their expanse of knowledge as well as develop valuable characteristics.
- Building a cohesive team based on the respect, communication, creativity, and commitment of individual members.

### **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 but not limited to 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. 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 can be programmed using many different programming languages. Teams are also required to raise funds, design and market their team brand, and do community outreach, and exemplars can win awards.

### 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 organization 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 advice on various tasks.

The project manager is a role taken on by a team member and has the responsibility of scheduling deadlines, overseeing each subteam, and assigning jobs. This team member should possess organizational and management skills and works closely with mentors and all subteam leads.

Individual subteam leads, including the Design/Build Lead, Integration Lead, Programming Lead, Documentation Lead, and Marketing Lead are roles 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.

## **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 2019-2020 season, MOE's outreach program aims to expand upon what was achieved last year.

- MOE typically participates in/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:
  - National Chemistry Week at the Independence School (2015-2019)
  - Gravity Festival at Bellevue Community Center (2017-2019)
  - Delaware Natural History Museum Summer Camp (2018-2019)
  - Hagley Maker Fair/Weekend Events (2017-2019)
  - FebFest at the Independence School (2019-2020)
  - Hagley STEM-tastic Weekends (2020)
- MOE team members maintain an active presence on international communication platforms including Discord and the FIRST Tech Challenge Reddit. These online sites only allow for easy, mutual idea sharing and collaboration.
- MOE frequently meets or corresponds with fellow FTC teams. The team strives to form constructive, long-term relationships with as many teams as possible.

### 2.3 Marketing

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

- For the 2019-2020 season, one of the team's goals was to redo and republish the team website. Using the tool website builder Squarespace, team members were able to create a new website with the following features:
  - Welcome page with introduction to FIRST™ and FTC
  - Team updates and upcoming event schedule
  - List and description of sponsors
  - Gallery of photos from past and current seasons
  - Outreach photos and descriptions

- Resource page with links to FIRST™ websites, forums, etc.
- Engineering Notebook page with links to MOE's 2018-2019 Notebook
- MOE also uses social media as a part of its marketing campaign. Using Instagram, Twitter, and Facebook accounts, the team posts approximately 4 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 Connections

- **Rhyme Know Reason #8528 (DE)** - long-term connection
- **Dragonators #14541 (NJ)** - connected since 2018-2019
- **RoboKings #12993 (Australia)** - rookie team
- **Master-minds (Brazil)** - rookie team
- **Lyrics & Logic #13467 (DE)** - long-term connection
- **Razor Steel #12880 (PA)** - long-term connection
- **Kaizen Robotics #16378 (DE)** - rookie team
- **Juliette's Revenge #14851 (DE)** - connected since 2018-2019
- **RobAUKtics #395 (DE)** - long-term connection

#### 3.3 Sponsors

MOE's 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.

Specifically for 2019-2020 SKYSTONE, student team members took the initiative in contacting a variety of companies and organizations with the goal of expanding the team's presence in the STEM community. After contacting over 15 companies with information on MOE and FIRST® programs, the team was able to procure a new sponsorship from REV Robotics.



MOE's sponsors for the 2019-2020 season are:

- **Labware** - MOE has been in contact with Labware's founder, Vance Kershner, for multiple years. This year, the company graciously donated \$5,000. MOE communicates its plans through emails and has organized robot demonstrations at company events.
- **DuPont** - 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.
- **Corteva** - MOE has been in partnership with Corteva for several years. Corteva provides financial support and is a major agricultural chemical and seed company.
- **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 participated in demonstration events for the company.
- **REV Robotics (\*new this season)** - REV offers an annual sponsorship opportunity for approximately 50 FTC teams. 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.

## 4.0 S.W.O.T. ANALYSIS

### 4.1 Overview

MOE 365 understands that capitalizing on strengths and opportunities while counterbalancing weaknesses and threats are 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, and the conversation is summarized below.

## 4.2 Strengths

Team strengths include:

- Human Resources - For the 2019-2020 season, MOE has a large roster of fifteen student team members. The team hopes to use these assets to maximize its production, attention to detail, and impact on the community.
- Experience - Between its eleven returning team members, MOE has a combined twenty-three years of student experience. The team is also has many veteran mentors with 1-13 years of prior involvement.
- Mentor Support - MOE is proud to have the help of many experienced and diverse mentors 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 a conference room and lab space courtesy of DuPont. This is an invaluable resource for the team.
- 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.
- Connections with Delaware teams - Over the years, MOE has been able to foster relationships and collaborative efforts with many teams in the Delaware region. This motivated the team to seek connections with teams in other states and countries.

## 4.3 Weaknesses

Team weaknesses include:

- Finding New Connection Opportunities - In past years, MOE has relied on existing and legacy events. This led the team to focus on finding new opportunities for the 2019-2020 SKYSTONE season, such as connecting with international teams and seeking out new sponsors.
- Time Management - One weakness that the team identified from last season is effectively scheduling deadlines and working productively. This year, MOE implemented

a new system of planning deliverables, establishing and updating a timeline, and giving weekly subteam updates.

- Student Mechanical Experience - The team does not feel as strong in mechanical functions as it would like. We plan to improve this by having veteran members pass on skills to new members and experimenting with new mechanical designs.
- Drive Practice - In past years, the team has not had the time to do adequate amounts of dedicated drive practice. This means that scheduling and time management are important to emphasize this season. We will accomplish this by using an updating season timeline and deliverables.

#### 4.4 Opportunities

Team opportunities include:

- Sponsor Expansion - MOE has been supported by legacy sponsors for many years, but this year the team focused on expanding its base of patron organizations and companies. More information on MOE's sponsors can be found in the 3.3 Sponsors section.
- Marketing - In past seasons, MOE has not consistently updated its website or social media pages. However, this year the team created a schedule for social media posts and designed and launched a new website using SquareSpace.
- Improve Outreach Program - While MOE has attended many community events in past years, the team plans to improve its outreach program by having a clearly defined purpose for every outreach and actively seeking new opportunities.
- Improve Documentation - MOE was proud of its 2018-2019 Engineering Notebook but can still become more thorough, disciplined, and detailed when documenting.

Specifically, the team aims to improve on the following areas:

- Record calculations, measurements, and individual trials
  - Take a viewpoint that is more objective than subjective
  - Get all team members consistently documenting
  - Document game strategy, how it evolves, and how it affects decision-making
  - Summarize progression through a dedicated engineering summary section
- Scheduling - While time management has been a team weakness in the past, MOE wants to take advantage of this by implementing a timeline review section in every notebook entry and maintaining a clear schedule of deadlines and deliverables.

## 4.5 Threats

Team threats include:

- Team Graduates - Of the fifteen student team members, five are high school seniors who will be graduating from the team after the 2019 season. Because of this, MOE aims to place a heightened emphasis on developing both skills and leadership abilities among its younger members so that the team will be able to transition seamlessly into the 2020-2021 season.
- Local Development - Due to the fact that the number of Delaware teams qualifying for the World Championships has been reduced from two to one, MOE recognizes the fact that the state's FTC teams have not progressed as quickly as in other regions. This means that, for 2019-2020 SKYSTONE, MOE has worked hard to expand the FTC program and collaborate with other teams to raise the level of competition in Delaware.
- Lack of Out-of-state Qualifiers - Between the FTC programs in Pennsylvania, New Jersey, and Maryland, MOE has only consistently competed in Pennsylvania. If MOE wants to expand its presence, the team must apply for more out-of-state competitions and support these FTC programs to set up more qualifiers and meets.

## 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 is 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 realistic but 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 2019-2020 SKYSTONE season are:

- Procure two new sponsors. This goal will encourage the team to connect with the local engineering community, invest in sustainability, and gain practice in funding and donation requests. It will also set the team up for long term relationships that can be maintained for years to come.
- Attend or host 2 outreaches per month (average). This goal reinforces the importance of outreach and giving back. It will push the team to seek out new opportunities in forming connections and to expand impact to more organizations and people.
- Every student organizes one outreach this calendar year. This goal supports the core belief that every member contributes to the success of the team. It encourages initiative, leadership, and responsibility so that students can gain experience communicating and organizing events.
- Relaunch the team website and post on social media 6 times per month. This goal encourages students to gain experience with marketing and share their progress and thinking with the online world. It will help the team become more involved in the global FTC community and stick to scheduling deadlines.
- Develop, film, and submit a Promote Video submission. This goal will keep the team on track and engaged in all areas of the FTC program. It will ensure that all students have a project to work on at all times and that MOE is spreading its message of STEM to a greater audience.
- Set time-sensitive deliverables at least twice per month for each subteam. This goal encourages students to stick to the design process and document the smaller goals and

decisions made along the way. It ensures that the team is making progress and that completing work with intention and foresight.

## **6.0 SUSTAINABILITY**

### **6.1 Future Plans**

MOE 365 takes pride in its actions, and in order to ensure a continuous incline of progress 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 Axalta, 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 the sponsor 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 FTC is a team that that is helpful and resourceful to the FIRST community. This ranges from providing information for newer teams so they can take their first step or sharing ideas for the season with other teams, and it is an important characteristic for the team to develop and expand upon.
- It is important for MOE 365 to continue giving back to the local community, participating in outreaches that can inspire other students to be involved in STEM related activities. The team hopes to educate younger children on the importance of STEM and possibly help them to become leaders in the industry, but first and foremost to help them find passion and interest in the subject itself. The team plans to accomplish this by continuing to participate in annual events, finding or organizing new events, and designing new demonstrations and outreach-specific robots.
- MOE 365 plans to expand its social media presence and online branding over the next few years. After launching an updated team website in October 2019, the team hopes to use the world wide web to spread its message and impact to a larger audience.

### **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 effort is dedicated to the continued recruitment and training of these personnel.

- MOE actively recruits new members from various schools and homeschool organizations through the use of social media posts, outreach events, and connections through school communities. MOE is constantly looking to expand the team to interested students. Not only does this benefit the team itself in gaining more members, it spreads the knowledge and importance of STEM to new people.
- MOE attracts new coaches and mentors primarily through connecting with coworkers, peers, and friends. 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.

## 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 consists primarily of registration fees, mechanical costs, spirit gear, and outreach materials.

### 7.2 Budget

| MOE 365 FTC 2018-2019 Income | 2018-19 | 2019-20 Estimated |
|------------------------------|---------|-------------------|
| <b>Sponsors</b>              |         |                   |
| LabWare                      | \$5,000 | \$5,000           |

## MOE 365 FTC ENGINEERING NOTEBOOK — SKYSTONE 2019-20

|                               |                 |                 |
|-------------------------------|-----------------|-----------------|
| Boeing                        | \$275           | \$275           |
| United Therapeutic            | \$4,000         | \$0             |
| Students                      | \$0             | \$0             |
| Fundraising                   | \$1,300         | \$0             |
| Horsey Fund                   | \$1,000         | \$1,000         |
| REV                           |                 | \$250           |
|                               |                 |                 |
| <b>Misc.</b>                  |                 |                 |
| Carry Over from Previous Year | \$7,043         | \$4,829         |
| Boeing Volunteer Grant        |                 |                 |
| Boeing Gift Match             | \$3,000         | \$4,600         |
|                               |                 |                 |
| <b>Income Total</b>           | <b>\$21,618</b> | <b>\$15,954</b> |

### 7.3 Expenses

| MOE 365 FTC 2018-2019 Expenses            | 2018-19 | 2019-20 Estimated |
|---|---------|-------------------|
| <b>Registration Fees</b>                  |         |                   |
| FTC Team 365 FIRST Registration           | \$275   | \$275             |
| FTC Team 365 DSFTC Registration           | \$250   | \$250             |
| FTC Team 365 PA Qualifier 1               | \$100   | \$100             |
| FTC Team 365 PA Qualifier 2               | \$100   | \$100             |
| FTC Team 365 NJ Qualifier 1               | \$0     | \$0               |
| FTC Team 365 MD Qualifier 1               | \$0     | \$0               |
| FTC Team 365 NJ State Championship        | \$0     | \$0               |
| FTC Team 365 MD State Championship        | \$0     | \$0               |
| FTC Team 365 PA State Championship        | \$250   | \$250             |
| FTC Team 365 World Championship (Detroit) | \$2,000 | \$2,000           |
| FTC Team 365 DE Meet 1                    | \$50    | \$50              |
| FTC Team 365 DE Meet 2                    | \$50    | \$50              |
|   |         |                   |
| <b>Jerseys</b>                            |         |                   |
| Students/Mentors                          | \$600   | \$800             |
| Hoodies/Jackets                           | \$100   | \$200             |
|   |         |                   |



## MOE 365 FTC ENGINEERING NOTEBOOK — SKYSTONE 2019-20

| <b>Parts</b>                    |          |          |
|---------------------------------|----------|----------|
| General Parts / Other Materials | \$5,000  | \$6,000  |
| REV Robotics                    | \$600    | \$450    |
| FTC Build Kit                   | \$0      | \$0      |
| Android Phones (4)              | \$200    | \$0      |
| Xbox 360 Gamepads (4)           | \$108    | \$0      |
| Website/Domain                  | \$20     | \$20     |
| TeamSnap                        |          | \$130    |
|                                 |          |          |
| <b>Outreach</b>                 |          |          |
| Outreach Materials              | \$300    | \$300    |
| Business Plans Print            | \$100    | \$0      |
|                                 |          |          |
| <b>Misc.</b>                    |          |          |
| End of Season MOE FTC Party     | \$300    | \$800    |
| Food                            | \$200    | \$200    |
|                                 |          |          |
| Expense Total                   | \$10,603 | \$11,975 |

## 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>
- Twitter: <https://twitter.com/MOE365FTC>
- Instagram: <https://www.instagram.com/miraclesofengineeringftc/>
- YouTube Channel: <https://www.youtube.com/user/moe365ftc>
- Facebook: <https://www.facebook.com/MOEFtc?fref=ts>