FIRST TECH CHALLENGE

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2023-2024 *FIRST*® Tech Challenge

Game Manual Part 1 – Remote Events

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Revision History		
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1.0 Introduction

What is FIRST® Tech Challenge?

FIRST® Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks. Participants and alumni of *FIRST* programs gain access to education and career discovery opportunities, connections to exclusive scholarships and employers, and a place in the *FIRST* community for life. To learn more about *FIRST*® Tech Challenge and other *FIRST*® Programs, visit www.firstinspires.org.

FIRST Core Values

The *FIRST* Core Values emphasize friendly sportsmanship, respect for the contributions of others, teamwork, learning, and community involvement and are part of our commitment to fostering, cultivating, and preserving a culture of equity, diversity, and inclusion. The *FIRST* Community expresses the *FIRST* philosophies of *Gracious Professionalism*® and *Coopertition*® through our Core Values:

- **Discovery:** *We explore new skills and ideas.*
- **Innovation:** *We use creativity and persistence to solve problems.*
- **Impact:** *We apply what we learn to improve our world.*
- **Inclusion:** *We respect each other and embrace our differences.*
- **Teamwork:** *We are stronger when we work together.*
- **Fun:** *We enjoy and celebrate what we do!*

2.0 *Gracious Professionalism*®

FIRST® uses this term to describe our programs' intent.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.

Watch Dr. Woodie Flowers explain *Gracious Professionalism* in this short video.

3.0 The Competition –Rules and Definitions

3.1 Overview

Students that engage in the *FIRST* Tech Challenge program develop Science, Technology, Engineering, and Math (STEM) skills and practice engineering principles while realizing the value of hard work, innovation, and sharing ideas. *Competitions* are exciting sporting events with *Robot Matches*, judging interviews, and *Teams* and *Robot* performance awards. This section provides critical information that will help *Teams* have a fun and successful *Competition* day.

There are three formats of *Competition* a *Team* might experience this season; traditional, remote, and hybrid events. This manual describes traditional events; however, some *Teams* may switch between formats depending on social distancing rules within their state/region. Below are descriptions of these formats.

3.1.1 Traditional Events

A traditional *FIRST* Tech Challenge event is typically held in a school or college gymnasium, where *Teams* use *Robots* to compete in the current season's game challenge. *Teams* participating in traditional events compete with *Alliance* partners in a head-to-head style of competition on the official *FIRST* Tech Challenge *Playing Field*. *Teams* compete in a series of *Matches* that determine their ranking at a traditional *Tournament*. The size

of a traditional event can range anywhere from 8 *Teams* to over 50 *Teams* competing in one place. Traditional events are generally scheduled by the local program delivery partner, and are run by many volunteers including referees, judges, scorekeepers, queuers, and other key volunteers. Traditional events consist of *Robot* inspections, *Robot Competitions*, judging interviews (for most *Competitions*), and an overall celebration of *Teams* and their accomplishments.

3.1.2 Remote Events

Remote events were developed to mimic traditional *FIRST* Tech Challenge events, while practicing social distancing guidelines. Since *Teams* may not be able to gather and compete in the traditional head-to-head competition format, the season's official full *Playing Field* has been adapted to allow *Teams* to play as a single *Team*. Remote *Teams* may order an official half version of this season's field, or compete using a modified version of the field, which will be released at kickoff on 9/9/2023. *Teams* will sign-up for events and will be provided with a time window to submit their own *Match* scores, which will determine their rankings. Unlike traditional events, the scoring of the official *Matches* is done by the *Team*, rather than an event volunteer. *Teams* will participate in judging interviews via video conference when judging is part of the event. To learn more about remote events, please read the Game Manual Part 1 – Remote Events manual.

3.1.3 Hybrid Events

A Hybrid event blends traditional in-person match play with judging interviews held via video conference. *Teams* use *Robots* to compete in the current season's game challenge in the traditional style of an in-person event and participate in judging remotely using a video conferencing tool for their initial and follow-up presentations with the judge panel.

3.2 Eligibility to Compete in Official FIRST Tech Challenge Competitions:

3.2.1 North America Team Registration

To compete in an official *FIRST* Tech Challenge *Competition* at any level, a *Team* must be registered and in good standing with *FIRST*.

1. The *Team* must complete the registration process through the Team Registration System.
2. The *Team* registration fee must be paid.
3. Two adults must pass the Youth Protection screening process.

3.2.2 Outside North America Registration

Teams outside of North America are required to register through the Team Registration System. Fees will not be due to *FIRST* for the registration. *Teams* outside of North America should consult the program delivery partner in their region for program fees and product purchase.

3.2.3 Youth Team Member Registration

Every youth *Team* member competing on a *FIRST* Tech Challenge *Team* is required to register through the https://www.firstinspires.org dashboard. Every *Team* member's parent or legal guardian must then electronically accept the consent and release form. Instructions on how to register youth *Team* members can be found on our website: https://www.firstinspires.org/resource-library/youth-registration-system

3.3 Competition Types

FIRST Tech Challenge has several types of *Competitions* categorized as official or unofficial events. These *Competitions* are created and managed by the regional program delivery partner (PDP) and hosted by a tournament director or local *Team* throughout the *FIRST* Tech Challenge season and off season. Information regarding regional events can be found on https://ftc-events.firstinspires.org. The advancement criteria for moving to the next *Tournament* level is detailed in section 6.0.

3.3.1 Scrimmage
A scrimmage is an unofficial *FIRST* Tech Challenge event where *Teams* help each other improve their *Robots*, play *Robot Matches*, attend workshops, and socialize. Anyone can host a scrimmage to prepare for an official *Competition*. *Teams* hosting a scrimmage are required to tell their local program delivery partner that such an event is taking place. *Teams* that choose to create and host a local scrimmage are responsible for finding a location, organizing the format for the day, and inviting other *Teams* to participate. *Teams* may also have to secure the field elements, computers, and other items.

3.3.2 League Meets
A league meet is an official *FIRST* Tech Challenge *Competition* in which a *Team's* rankings follow the *Team* to future meets and the league *Tournament*. League meets include *Qualification Matches* but no judging sessions, awards, or *Elimination Matches*. *Teams* participating in league meets are expected to play in a minimum of ten *Qualification Matches* spread across several meets prior to the league *Tournament*. Whenever possible, it is highly encouraged that *Teams* participate in as many meets as they can. Rankings from one meet to the next accumulate as outlined in section 5.3.

3.3.3 Qualifying Tournaments and League Tournaments
League *Tournaments* and qualifying *Tournaments* include *Qualification Matches*, *Elimination Matches*, judging sessions and awards. *Teams* may compete in multiple qualifying *Tournaments* in a season. *Teams* may only participate in one league for the season, and therefore only one league *Tournament* each season. Qualifying *Tournaments* and league *Tournaments* are held before regional championship *Tournaments*. The number of *Teams* advancing to the regional championship *Tournament* depends on the capacity of the regional championship *Tournament*, the number of qualifying *Tournaments* and/or league *Tournaments*, and the number of *Teams* attending the *Tournaments*.

3.3.4 Super Qualifying Tournaments
A super qualifying *Tournament* is an official *FIRST* Tech Challenge *Competition* in which *Teams* participate in qualifying *Tournaments* and/or a league *Tournament* to advance to the super qualifying *Tournament*, then advance to the regional championship *Tournament*. These *Tournaments* are held in regions with large numbers of *Teams*.

3.3.5 Regional Championship Tournaments
Regional championship *Tournaments* are hosted and managed by a *FIRST* Tech Challenge program delivery partner. In most regions, *Teams* are required to advance from a qualifying *Tournament* or league *Tournament* to participate, while some regions host a single regional championship *Tournament*. Regional Championship *Tournaments* may include *Teams* from a geographic region, province, state, country, or several countries. *Teams* should expect a higher level of *Competition*, both on the field and in the judging sessions at regional championship *Tournaments*.

3.3.6 *FIRST* Championship
Hosted and managed by *FIRST,* the *FIRST* Championship, held in Houston, Texas is the culminating event for all *FIRST* programs. *FIRST* Tech Challenge *Teams* advance to the *FIRST* Championship through their regional championship *Tournament*. The *FIRST* Championship includes *Teams* from many countries, and *Teams* should expect a higher level of *Competition*, both on the field and in the judging sessions.

3.4 Competition Definitions
The following definitions and terms are used for a *FIRST* Tech Challenge *Competition*. Defined terms begin with a capital letter and are italicized throughout the manual (for example, *Alliance*). Competition rules mean exactly and only what it plainly says. If a word isn't given a game definition, then you should use its common conversational meaning.

Alliance Station – The designated "red" or "blue" *Alliance* area next to the *Playing Field* where the *Drive Team* stands or moves within during a *Match*. *Station One* is the position in the *Alliance Station* that is closest to the audience.

AprilTag – A visual fiducial system, useful for a wide variety of tasks including augmented reality, robotics, and camera calibration[1]. Information about *AprilTags* may be found here: https://ftc-docs.firstinspires.org/en/latest/apriltag-intro.

[1] See https://april.eecs.umich.edu/software/apriltag accessed on 5/18/2023.

Autonomous Period – A thirty-second (0:30) *Match* period in which the *Robots* operate and react only to sensor inputs and to commands pre-programmed by the *Team* into the onboard *Robot* control system. Human control of the *Robot* is not permitted during this period.

Competition – A *Competition* is an activity a *Team* attends as part of the *FIRST* Tech Challenge program that is organized or sanctioned by the local program delivery partner or *FIRST* Headquarters. *Competitions* are all levels of *FIRST* Tech Challenge events that include *Robot Matches* or judging.

Competition Area – The *Area* where all the *Playing Fields,* scoring areas*, Alliance Stations,* scoring tables, and other *Competition* officials and tables are located.

Drive Team - Up to four representatives two (2) drivers, one (1) human player, and one (1) coach from the same *Team*.

Driver-Controlled Period – The two-minute (2:00) *Match* time period in which the drivers operate the *Robot*.

End Game – The last thirty seconds of the two-minute (2:00) *Driver-Controlled Period*.

Match - *Matches* are made up of several periods totaling two minutes and thirty seconds (2:30). There is a thirty (30) second *Autonomous Period*, followed by a two (2) minute *Driver-Controlled Period*. The last thirty (30) seconds of the *Driver-Controlled Period* is called the *End Game*. There is an eight-second transition between the *Autonomous Period* and the *Driver-Controlled Period* for *Teams* to pick up the controllers and switch programs.

Penalty - The consequence imposed for a rule or procedure violation that is identified by a referee. *Penalties* may also include and/or escalate to the issuing of a yellow card or red card as a result of a continued occurrence of a rule violation and upon discretion of the Referee. Please see rule <C03> for yellow and red card definitions.

> Traditional Events - An *Alliance's Penalty* points are added to the opposing *Alliance's* score at the end of the *Match*. *Penalties* are further categorized into *Minor Penalties* and *Major Penalties.*
>
> Remote Events - When a *Penalty* occurs, points are deducted from the *Score* of the *Team* that incurred the *Penalty*. *Penalties* are further categorized into *Minor Penalties* and *Major Penalties.*

Playing Field – The part of the *Competition Area* that includes the 12 ft. x 12 ft. (3.66 m x 3.66 m) field and all the elements described in the official field drawings.

Practice Match – A *Match* used to provide time for *Teams* to get familiar with the official *Playing Field*.

Qualification Match – A *Match* used to earn *Ranking Points* and *Tiebreaker Points*.

Ranking Points – Points that *Teams* earn for playing a *Match* that are subsequently used in the competition ranking calculation (for more information, see Section 5).

Traditional Events – *Teams* earn *Ranking Points* for winning (two points), tying (one point), or losing or disqualification/no show (zero points) in a *Qualification Match*.

Remote Events – For a single *Team* competing remotely, the ***Team's*** final score (after applying *Penalties*) for a *Match* is used as their *Ranking Points*.

Robot - Any mechanism that has passed inspection and a *Team* places on the *Playing Field* before the start of a *Match*. To be legal, *Robots* must comply with the *Robot* build rules in section 7.0 of this manual.

Student - A person who has not completed high-school, secondary school, or the comparable level as of September 1st prior to the season Kickoff.

Team – Mentors, supporters, and *Students* affiliated with an entity registered with *FIRST*. An official *FIRST* Tech Challenge *Team* consists of no less than two (2) and more than fifteen (15) *Student Team* members and is designed for *Students* in grades 7-12. *Students* cannot be older than high school-aged if they are participating *Team* members. All *Teams* are required to register through the Team Registration System. For eligibility to compete *in FIRST* Tech Challenge events, please see section 3.2 of this document.

TieBreaker Points/Average TBP – *TieBreaker Points* are used as the tiebreakers when *Teams* have equal average *Ranking Points.* There are two types of *TieBreaker Points*, *TBP1* and *TBP2*.

Traditional Events – For *Teams* that compete at a traditional *Competition*,

TBP1: Each *Team* receives their *Alliance's Autonomous Period* score for a *Qualification Match* as *TBP1*. *Average TBP1* is the sum of the *TBP1s* of all non-*Surrogate Qualification Matches* divided by the number of *Matches* that a *Team* plays in a *Competition*.

TBP2: Each *Team* receives their *Alliance's End Game* specific task score for a *Qualification Match* as *TBP2*. *Average TBP2* is the sum of the *TBP2s* of all non-*Surrogate Qualification Matches* divided by the number of *Matches* that a *Team* plays in a *Competition*.

Remote Events – For a single *Team* competing remotely,

TBP1: Each Team receives their Autonomous Period score for a Qualification Match as TBP1.

TBP2: Each *Team* receives their *End Game* specific task score for a *Qualification Match* as *TBP2*.

Please see section 5.0 for further explanation for how this is used to determine a ***Team's*** ranking.

Tournament – A *Tournament* is an event that advances *Teams* to the next level of *Competition* within a state/region, or to the *FIRST* championship.

3.5 Competition Rules

<C01> Egregious Behavior -

Egregious *Robot* or *Team* member behavior is not in the spirit of Gracious Professionalism and will not be tolerated at a *FIRST* Tech Challenge event. Egregious behavior includes, but is not limited to, repeated and/or flagrant violation of rules, unsafe behavior or actions, and uncivil behavior towards *Drive Team,* competition personnel, or event attendees. In most cases, as determined by the referees, the offending team will result in a *Major Penalty* and issuance of a *Yellow Card* and/or *Red Card*. Subsequent violations may result in Team disqualification from the competition.

Continued and repeated violations will be brought to *FIRST* Headquarters attention. *FIRST* Headquarters will work with event staff to determine if further escalations are necessary, which can include removal from award consideration, and removal from the event.

In cases where the egregious behavior is deemed to be unsafe, such as physical contact or threatening behaviors to other event attendees, event staff will work with *FIRST* Headquarters to determine if the behavior warrants immediate removal of the team from the event.

<C05> One *Robot* Per *Team* - Each registered *Team* may enter only one *Robot* (a *Robot* built to play the current season's game challenge) into the *FIRST* Tech Challenge *Competition*. It is expected that *Teams* will make changes to their *Robot* throughout the season and at *Competition*s.

a. It is against this rule to compete with one *Robot* while a second is being adjusted or assembled at a *Competition*.

b. It is against this rule to switch back and forth between multiple *Robots* at a *Competition*.

c. It is against this rule to use multiple *Robots* to register and attend concurrent traditional *Competitions*.

d. It is against this rule to use a *Robot* built by another *Team*.*

Violations of this rule will immediately be considered deliberate and egregious.

*Exceptions can be made for extenuating circumstances for *Teams* that need assistance from another *Team* with the operation of their *Robot*. For example, *Teams* loaning out *Drive Team* members to another *Team* whose drivers have not arrived/must leave early. In events such as this, the *Teams* involved should notify the tournament director of the extenuating circumstance.

<C07> *Qualification Match Count* - *Teams* competing in a meet, league *Tournament*, qualifying *Tournament*, and regional championship *Tournament* will compete in either five (5) or six (6) *Qualification Matches* as determined by the tournament director*. Teams* competing remotely will have a total of six (6) *Qualification Matches*.

<C15> Safety Glasses - All *Team* members, coaches, and their guests must wear ANSI Z87.1 certified safety glasses while in the *Pit* or *Competition Area*. Prescription glasses with ANSI Z87.1 approved Commercial Off-The-Shelf (COTS) side shields are also allowed.

<C16> Battery Safety - Batteries must be charged in an open, well-ventilated area.

<C17> Footwear Safety - Open-toed or open-backed shoes are not allowed in the *Pit Area* or in the *Competition Area*.

<C18> General Safety - Running, skateboarding, roller skating, 'hover boards', and/or flying drones are not allowed at any *Competition* unless specified by game specific rules. These can create safety hazards to the *Teams*, spectators, or volunteers attending the *Competition*.

<C20> Hazardous Materials - Painting or applying harmful products, sprays, glues, or aerosols are not allowed anywhere at the *Competition*. This includes the *Pit*, *Competition*, and spectator areas.

Note: *Teams* may apply antistatic spray to their *Robot* if done outside the venue.

<C28> Government and Venue Requirements – *Teams* must comply with government and venue specific requirements (for example, wearing a mask, social distancing, tornado warning procedures, etc.).

4.0 Competition Day Outline

Remote *Competitions* are a way for *Teams* to compete while practicing social distancing. *Teams* are required to register with *FIRST* to access the cloud-based scoring system where their official *Matches* are submitted. This section of the manual outlines what *Teams* should expect while competing in remote competitions.

4.1 Consent and Release Forms and Team Roster

Each student competing at a *FIRST* Tech Challenge *Competition* must have a signed consent and release form completed by a parent or legal guardian. **Students cannot compete without a signed consent and release form**. These forms must be filled out electronically through the *FIRST* dashboard. A parent or legal guardian of the student can create a youth *Team* member registration through the *FIRST* website and complete the consent and release form online.

4.2 Remote Competition Registration

Once a *Team* registers with *FIRST*, they must also register for their *Competition*. For event information such as dates, registration, and format, *Teams* should contact their local program delivery partner.

4.3 Judges' Interviews

At *FIRST* Tech Challenge *Competitions*, there are three parts to the judging process: 1) interview with judges; 2) evaluation of performance during the *Tournament,* and 3) evaluation of the engineering portfolio. Each *Team* will have a ten to fifteen minute "fact-finding" interview with a panel of two or three judges. At the start of the interview, *Teams* will have a maximum of 5 minutes to present to the judges. After the *Team's* five-minute presentation, the judges will have the opportunity to ask questions about the *Team*, the *Robot*, outreach efforts, etc.

Teams that compete in a remote *Competition* (except for league meets, where judging interviews do not take place) are eligible for judged awards. Judging interviews are held via video conference and will be set up by either the local program delivery partner, a judge advisor, or tournament director.

Teams that are participating in an event that do not have a *Robot* are still eligible to receive an interview, and are also eligible for judged awards.

4.4 Qualification Matches

Qualification Matches are the official *Matches* used to determine a *Teams* ranking. *Teams* will have up to a 7 day* window for the specific remote event(s) they are registered for to submit their six (6) official *Qualification Match* scores to *FIRST*. *Teams* are not required to play *Matches* on a specific date, however any unplayed/unscored *Qualification Matches* not submitted within the allotted timeframe will receive a zero score. *Teams* are ranked using their individual *Team* performance after their remote event ends.

*Please be sure to check with your local program delivery partner for details about the *Match* scoring window.

4.5 FTC Scoring Software

"The FTC Scoring System is an internet-based application that allows *Teams* to score their *Matches and* participate in judging sessions remotely*. Teams* can upload their engineering portfolios, control award submissions, request judging feedback, and provide official scores for their events through the cloud-based FTC Scoring System. *Teams* receive access to the software once they have registered for the season. Each *Team* can use their firstinspires.org *Team* dashboard user account to login to https://ftc-scoring.firstinspires.org/ and submit their *Qualification Match* scores. It is required that official *Qualification Match* scores be submitted via the FTC Scoring system for remote events within the event submission window to count toward the *Team's* rankings.

The FTC Scoring System is similar to the downloadable scoring system, FTC Live, used in traditional events. *Teams* can run the FTC Scoring system to use the *Match* timers, displays, and score their *Match* as the *Match* is played.

To run the software to score a *Match* in real-time, an internet connection is required. For *Teams* competing in a location that does not have high speed internet access, the *Team* may use paper scoresheets to record the status of the *Match*. The *Team* must then ensure that the scores recorded on paper are submitted to the PDP or event admin before the remote event deadline for scores to be published.

More detailed information, such as scoring guides and video tutorials, can be found on our website: https://www.firstinspires.org/node/5146

Teams can also find remote resources on our YouTube channel: https://www.youtube.com/user/FIRSTTechChallenge

4.6 Awards and Closing Ceremony

The awards and closing ceremony celebrate the *Teams* and their accomplishments throughout the *Competition*, as well as the volunteers who helped make the *Competition* possible. At the awards and closing ceremony, the finalists and winners of each award are announced. For *Teams* competing in remote events, the awards and closing ceremony is generally done by video conference or pre-recorded broadcast.

5.0 Calculating Scores and Ranking

5.1 Competition Ranking Calculation

Ranking Points and *TieBreaker Points* are awarded at the end of each *Match. Teams* that are *Surrogates*, *Disqualified,* or do not show up (no show) for a *Match* receive zero *Score*, *Ranking*, and *TieBreaker Point* contributions towards their *Ranking* calculation. Please note that *Ranking Points* differ from traditional to remote events. Please see the definition of *Ranking Points* and *TieBreaker* points in section 3.4 of this manual.

5.1.1 Traditional Events –
Each *Team* at a *Competition* is ranked according to the following sort order:

1. Averaged *Ranking Points*; highest to lowest, then
2. Averaged *TieBreaker Points (TBP1)*; highest to lowest, then
3. Averaged *TieBreaker Points (TBP2)*; highest to lowest, then
4. Highest *Match* Score (including *Penalties*), then
5. Random Electronic Draw

Averages are based on the number of *Matches* played during a *Competition. Teams* may be required to play a *Surrogate Match,* which is an extra *Match* marked by an asterisk on *a Team's Match* schedule. The added *Surrogate Match* does not count towards their rankings or averages during the *Competition.*

5.1.2 Remote Events –
Each *Team* at a *Competition* is ranked according to the following sort order:

1. Averaged *Ranking Points*; highest to lowest, then
2. Averaged *TieBreaker Points (TBP1)*; highest to lowest, then
3. Averaged *TieBreaker Points (TBP2)*; highest to lowest, then
4. Highest *Match* Score (including *Penalties*), then

5. Random Electronic Draw

Averages are based on the number of *Matches* played during a *Competition.*

5.2 League Meet and Tournament Ranking

League tournament *Team* rankings are based on the top ten (10) *Matches* from all previous league meets plus all *Matches* played at the league tournament. The ten (10) league meet Matches are selected using the sort order from Section 5.1. All *Teams* at a league tournament are ranked based on the same total number of *Matches* (either 15 or 16 depending on the number of Qualifying Matches at the league tournament). *Teams* that played fewer than ten (10) *Matches* at meets will have *Ranking Points* and *TieBreaker Points* that are effectively zero for the missing *Matches*.

5.2.1 League Meet Ranking

1. Meet Ranking – For meets that track the ranking of *Teams* attending that meet, rankings are based on matches played at that meet using the sort order described in section 5.1. Averages for ranking are calculated based on ten (10) *Matches*, regardless of the number of matches played by a *Team*.
2. League Meet Ranking – A *Team's* league ranking is based on their performance at all of the meets attended up until that event. The *Team's* cumulative league ranking calculation is based on the average of the best ten (10) league meet *Matches* selected using the sort order described in Section 5.1. For *Teams* with fewer than ten (10) played meet *Matches* the *Ranking Points* and *TieBreaker Points* will be effectively zero for the unplayed *Matches*.

5.2.2 League Tournament Ranking

League tournament rankings are based on the cumulative meet league ranking described in section 5.2.1 plus all of the *Matches* played at the league tournament. Ranking averages are calculated across all of the cumulative ten (10) league meet *Matches* described in section 5.2.1 plus all *Matches* played at the league tournament.

5.3 Penalties

5.3.1 Traditional Events

An *Alliance's Penalty* points are added to the opposing *Alliance's* score at the end of the *Match*.

5.3.2 Remote Events

Penalty points are subtracted from the *Team's Score*. A *Team's* intermediate score will go negative if the *Penalties* incurred are more than the points they have earned in a *Match*. However, any negative net score will be recorded as zero (0) as the final *Match* score.

6.0 Advancement Criteria

6.1 Eligibility for Advancement

Teams are only eligible to advance from events within their *Home Region***.** *Teams* may choose to compete at *Tournaments* outside of their *Home Region*, however, do so for the opportunity of additional gameplay and to compete with other teams from outside of their area. *Teams* may NOT advance from *Tournaments* outside of their *Home Region*.

Teams may only compete in one league and one league *Tournament* per season.

New this season: *Teams* may only advance to the next level of competition from their *Home Region*.

This applies to both *Teams* in North America, and *Teams* outside of North America:

Tournament Type	Advances To	Special Considerations
League *Tournament*	• Super Qualifying *Tournament* • Regional Championship *Tournament*	• A *Team* is eligible to advance to the next *Competition* tier from the League *Tournament* they attend. *Teams* can only compete in one league, and therefore only one League *Tournament*.
Qualifying *Tournament*	• Super Qualifying *Tournament* • Regional Championship *Tournament*	• A *Team* may participate in more than one qualifying *Tournament* within their *Home Region* but are not eligible for consideration for awards at *Tournaments* beyond their third.
Super Qualifying *Tournament*	• Regional Championship *Tournament*	• *Teams* advance from their *Home Region* super qualifying *Tournament* to their *Home Region's* regional championship. • *Teams* can only compete in one super qualifying *Tournament*.
Regional Championship *Tournament*	• *FIRST* Championship	• *Teams* advance from their *Home Region's* regional championship *Tournament* to the *FIRST* Championship.

6.1.1 Award Eligibility

Teams are eligible to be judged and considered for all awards (except for the Inspire award, see section 6.1.2 for details) at any *Tournament* they attend. *Teams* are eligible for advancement tied to the award within their *Home Region*. *Teams* may be a finalist or winner of an award when they are competing outside of their *Home Region* but are not eligible to advance.

6.1.2 Inspire Award Eligibility

Teams are only eligible to be considered for the inspire award at *Tournaments* within their own region. If a *Team* is competing outside of their *Home Region*, they cannot be considered for the inspire award, including 2nd and 3rd place inspire spots.

Teams that have won the inspire award at another qualifying *Tournament* cannot be considered for the inspire award or as an inspire award finalist at subsequent qualifying *Tournaments* within their *Home Region*.

All *Teams* are eligible to be considered for all judged awards at the *FIRST* championship.

6.2 Order of Advancement

If the *Team* listed has already advanced or there is no *Team* fitting that description (as in 2nd *Team* selected at smaller *Tournament*s, or 3rd place award finalists at smaller *Tournaments)*, the advancement will continue in order.

6.2 Order of Advancement

If the *Team* listed has already advanced or there is no *Team* fitting that description (as in Award 3rd place at events of 21 or fewer *Teams*) the advancement will continue in order.

1. Inspire Award Winner
2. Top Ranked Team
3. Inspire Award 2nd place
4. Top Ranked 2nd place Team
5. Inspire Award 3rd place*
6. Top Ranked 3rd place Team
7. Think Award Winner
8. Top Ranked 4th place Team
9. Connect Award Winner
10. Top Ranked 5th place Team
11. Innovate Award sponsored by Raytheon Technologies Winner
12. Top Ranked 6th place Team
13. Control Award sponsored by Arm Winner
14. Motivate Award Winner
15. Design Award Winner
16. Highest Ranked *Team* not previously advanced
17. Think Award 2nd Place
18. Highest Ranked *Team* not previously advanced
19. Connect Award 2nd Place
20. Highest Ranked Team not previously advanced
21. Innovate Award sponsored by Raytheon Technologies 2nd Place
22. Highest Ranked *Team* not previously advanced
23. Control Award sponsored by Arm 2nd Place
24. Highest Ranked *Team* not previously advanced
25. Motivate Award 2nd Place
26. Highest Ranked *Team* not previously advanced
27. Design Award 2nd Place
28. Highest Ranked *Team* not previously advanced

29. Think Award 3rd Place*
30. Highest Ranked *Team* not previously advanced
31. Connect Award 3rd Place*
32. Highest Ranked *Team* not previously advanced
33. Innovate Award sponsored by Raytheon Technologies 3rd Place*
34. Highest Ranked *Team* not previously advanced
35. Control Award sponsored by Arm 3rd Place*
36. Highest Ranked *Team* not previously advanced
37. Motivate Award 3rd Place*
38. Highest Ranked *Team* not previously advanced
39. Design Award 3rd Place*
40. Highest Ranked *Team* not previously advanced
41. Highest Ranked *Team* not previously advanced
42. Highest Ranked *Team* not previously advanced
43. Highest Ranked *Team* not previously advanced
44. Highest Ranked *Team* not previously advanced
45. Highest Ranked *Team* not previously advanced
46. Highest Ranked *Team* not previously advanced
47. Highest Ranked *Team* not previously advanced
48. Highest Ranked *Team* not previously advanced
49. Highest Ranked *Team* not previously advanced
50. Highest Ranked *Team* not previously advanced
51. Highest Ranked *Team* not previously advanced

* Events with 20 or fewer *Teams* may select an award winner and a single award finalist. Events with 21 or more *Teams* must select an award winner and a 2nd and 3rd place winner.

7.0 The Robot

7.1 Overview

A *FIRST* Tech Challenge *Robot* is a remotely operated vehicle designed and built by a registered *FIRST* Tech Challenge *Team* to perform specific tasks when competing in the annual game challenge. This section provides rules and requirements for the design and construction of a *Robot*. *Teams* should be familiar with the *Robot* and game rules before beginning *Robot* design.

7.2 Robot Control System

A *FIRST* Tech Challenge *Robot* is controlled by an Android-based platform. *Teams* will use two (2) *Android Devices* to control their *Robot.* One *Android Device* is mounted directly onto the *Robot* and acts as a *Robot Controller*. The other *Android Device* is connected to one or two gamepads to make up the *Driver Station*.

For more information, tutorials, and to access our Android Technology forum, please visit: https://www.firstinspires.org/resource-library/ftc/technology-information-and-resources.

7.2.1 *Robot* Technology Definitions

Android Device – An electronic device running the Android operating system. See rules <RE07> and <RS03> for a list of allowed devices and operating system versions.

Driver Station – Hardware and software used by a *Drive Team* to control their *Robot* during a *Match*.

Logic Level Converter – An electronic device that allows an encoder or sensor, that operates using 5V logic levels, to work with the *REV Expansion Hub* and/or *REV Control Hub*, which operates using 3.3V logic levels. This device may contain a step-up voltage converter (from 3.3V to 5V) and a dual channel, bidirectional logic level converter. This device may be used directly with a 5V digital sensor or with an *I2C Sensor Adaptor Cable* to a 5V I2C sensor.

I2C Sensor Adapter Cable – An adapter to change the pin orientation of the REV Robotics *Logic Level Converter* to match a Modern Robotics compatible I2C sensor.

Mini USB to OTG (On-The-Go) Micro Cable – The connection between the *Smartphone Android Device Robot Controller* and the *REV Expansion Hub*.

Op Mode – An *Op Mode* (short for "operational mode") is software that is used to customize the behavior of a *Competition Robot*. The *Robot Controller* executes a selected *Op Mode* to perform certain tasks during a *Match*.

OTG Micro Adapter – Connects a USB hub to Micro USB OTG (On-The-Go) port on a smartphone *Driver Station Android Device*.

REV Control Hub – An integrated *Android Device* with four (4) DC motor channels, six (6) servo channels, eight (8) digital I/O channels, four (4) analog input channels, and four (4) independent I2C buses.

REV Driver Hub - A compact mobile *Android Device* designed specifically for use as part of the *Driver Station*.

REV Expansion Hub – An integrated electronic device with four (4) DC motor channels, six (6) servo channels, eight (8) digital I/O channels, four (4) analog input channels, and four (4) independent I2C buses.

REV SPARKmini Motor Controller - An electronic device that accepts a PWM control signal (from a servo controller) and supplies 12V power to a DC motor.

REV Servo Power Module – An electronic device that boosts the power supplied to 3-wire servos. A *REV Servo Power Module* has 6 input servo ports and 6 matching output ports. It draws power from a 12V source

and provides 6V power to each output servo port. A *REV Servo Power Module* can provide up to 15A of current across all output servo ports for a total of 90 Watts of power per module.

Robot Controller – A *REV Control Hub* or an allowed smartphone *Android Device* connected to a *REV Expansion Hub* located on the *Robot* that processes *Team* written software, reads on-board sensors, and receives commands from the *Drive Team* by way of the *Driver Station*. The *Robot Controller* sends instructions to the motor and servo controllers to make the *Robot* move.

VEX Motor Controller 29 - An electronic device that accepts a PWM control signal from a servo controller through a *REV Servo Power Module* to drive a VEX EDR 393 motor.

Vision Camera – COTS devices with no more than one image sensor able to record or stream captured images and/or video. *Vision cameras* must be UVC compatible and must connect directly to a *REV Control Hub* via USB or to the *Robot Controller* through a powered USB hub. Common *Vision Cameras* are the Logitech C270 HD, Logitech C920 HD PRO, and Microsoft Lifecam HD-3000.

Vision Sensor – COTS devices with no more than one image sensor not able to record or stream captured images and/or video. Instead, the images and/or video is processed by on-board algorithms and only the results are communicated back to a computer or system. *Vision Sensors* must follow all sensor rules in <RE11>.

7.3 Robot Rules

Anyone that has attended a *FIRST* Tech Challenge *Competition* knows that *Teams* think outside the kit-of-parts (TETRIX and REV *FIRST* Tech Challenge Competition Sets, REV EDU Kit, etc.) to create unique and creative *Robot*s. The intent of the *Robot* construction rules is to create a level playing field and a framework for *Teams* to build *Robot*s that safely play the annual game challenge. *Teams* should read all the *Robot* rules before building their *Robot*. *Teams* can also reference our Legal and Illegal Parts List on our website for common legal and illegal *Robot* parts. Some suppliers' websites may claim that a part is *FIRST* Tech Challenge approved. The only official references for the legality of parts and materials are the Game Manual Part 1, the Legal and Illegal Parts List, and the Official Game Q&A Forum.

7.3.1 General *Robot* Rules

It is the intent of *FIRST* to encourage creativity in design as long as it does not present a safety hazard or unfairly affect the opportunities of any *Teams* to compete. Although there is significant creative freedom allowed in the *Robot* design rules, *Teams* should consider the adverse effects of any design decisions that they make. When considering your *Robot* design and your game strategy, ask yourself the following questions. If the answer to any of these questions is yes, the design part is not allowed:

- Could it damage or disable another *Robot*?
- Could it damage the *Playing Field*?
- Could it injure a participant or volunteer?
- Is there already a rule that restricts this?
- If everybody did this, would the gameplay be impossible?

<RG01> Illegal Parts - The following types of mechanisms and parts are not allowed:

a. Those used in a *Robot* drive system that could potentially damage the *Playing Field* and/or Scoring Elements such as high traction wheels (for example, AndyMark am-2256) and high grip tread (for example, Roughtop, AndyMark am-3309).

b. Those that could potentially damage or flip other competing *Robot*s.

c. Those that contain hazardous materials such as mercury switches, lead, or lead containing compounds, or lithium polymer batteries (except for the *Android Devices'* internal batteries).

d. Those that pose an unnecessary risk of entanglement.

e. Those that contain sharp edges or corners.

f. Those that contain animal-based materials (because of health and safety concerns).

g. Those that contain liquid or gel materials.

h. Those that contain materials that would cause a delay of game if released (for example, loose ball bearings, coffee beans, etc.).

i. Those that are designed to electrically ground the *Robot* frame to the *Playing Field*.

j. Closed gas devices (for example, gas storage vessel, gas spring, compressors, pneumatic tires, etc.).

k. Hydraulic devices.

l. Vacuum based mechanisms.

<RG02> Maximum Starting Size - The maximum size of the *Robot* for starting a *Match* is 18 inches (45.72 cm) wide by 18 inches (45.72 cm) long by 18 inches (45.72 cm) high. The only exceptions are:

a. Preloaded game elements may extend outside the starting size constraint.

b. Flexible materials (i.e., zip tie, surgical tube, string, etc.) may extend up to 0.25 inches (0.635 cm) beyond the 18 inch (45.72 cm) size constraint.

c. *Robots* may expand beyond the starting size constraint after the *Match* starts.

During inspection, a robot sizing tool will be used as the official gauge to make sure *Robots* comply with this rule. To pass inspection, a *Robot* must satisfy all of the following requirements:

d. *Robot* is placed on its drivetrain inside the robot size tool.

e. The *Robot* must maintain the same shape/configuration as it will have at the start of a *Match*.

f. Fit completely within the robot sizing tool in the same manner that it sits on the *Playing Field* floor at the start of a *Match*.

g. Be fully self-supported (i.e., does not exert force on the sides or top of the sizing tool) by either:

   i. A mechanical means while powered-off.

   ii. Powered-on using mechanical means and/or an *Autonomous Op Mode* initialization routine that pre-positions servo motors to the desired stationary position.

<RG03> *Team* Number Display - *Robot*s must prominently display their *Team* number (numerals only, for example "12345") on two separate signs. The intent of this rule is for field personnel to easily identify *Robot*s by *Team* number from at least 12 feet (3.66 meters) away.

a. *Team* number must be visible from at least **two** opposite sides of the *Robot* (180 degrees apart).

b. The numerals must each be at least 2.5 inches (6.35 cm) high and in a contrasting color from their background.

c. *Team* numbers must be robust enough to withstand the rigors of *Match* play. Example robust materials include: 1) self-adhesive numbers (mailbox or vinyl numbers) mounted on polycarbonate sheet, wood

panel, metal plate, etc. or 2) Ink jet or laser printed numbers on paper and laminated.

d. If used, illuminated *Team* numbers must be legible when they are not powered on.

<RG04> *Alliance* Marker – *Robots* must include a *Team* supplied, *Alliance* specific marker on two opposite sides of the *Robot* to easily identify which *Alliance* a *Robot* is assigned to. The *Alliance* marker must be displayed on the same side of the *Robot* as the *Team* number, within a 3-inch (7.62 cm) distance of the number. The intent of this rule is to allow field personnel to easily identify the *Robot's Alliance*.

a. The red *Alliance* marker must be a solid red square, 2.5 inches x 2.5 inches (6.35 cm x 6.35 cm) +/- 0.25 inches (0.64 cm).

b. The blue *Alliance* marker must be a solid blue circle, 2.5 inches (6.35 cm) +/- 0.25 inches (0.64 cm) in diameter.

c. The *Alliance* marker must be visible to the referees during a *Match* and must indicate the *Alliance* color for the *Match*.

d. The *Alliance* marker must be robust enough to withstand the rigors of *Match* play. Example robust materials include: 1) *Alliance* marker template printed and laminated; 2) painted or gaff tape covered polycarbonate sheet, wood panel, metal plate, etc.

It is highly recommended that the *Team* add their *Team* number anywhere to their *Alliance* marker. This allows field personnel the ability to return *Alliance* markers that might be left on the *Playing Field*.

An *Alliance* Marker template is located on the *FIRST* Tech Challenge game and season page https://www.firstinspires.org/resource-library/ftc/game-and-season-info

<RG05> Allowed Energy Sources - Energy used by *FIRST* Tech Challenge *Robot*s (that is, stored at the start of a *Match*), shall come only from the following sources:

a. Electrical energy drawn from approved batteries.

b. A change in the position of the *Robot* center of gravity.

c. Storage achieved by deformation of *Robot* parts. *Teams* must be careful when incorporating spring-like mechanisms or other items to store energy on their *Robot* by means of part or material deformation.

<RG06> Detached *Robot* Parts – *Robots* may not detach parts of the *Robot*. Tethered elements of the *Robot* are considered detached if either is able to move independently of the other.

<RG07> Propelling Game Scoring Elements – *Robot*s can propel (i.e., able to move independently of the *Robot*) scoring elements unless limited by a game specific rule. If allowed, *Robots* may only propel the elements with enough velocity to score. Propelling elements with excessive velocity could create a safety hazard for other *Teams* and field personnel. If the referees feel that a *Robot* is propelling scoring elements with excessive velocity, the *Robot* must be re-inspected. *Robot*s must then show that a propelled scoring element cannot travel in the air more than a 18 ft. (5.49 m) distance or more than 5 ft. (1.52 m) in elevation.

7.3.2 *Robot* Mechanical Parts and Materials Rules

<RM01> Allowed Materials - *Teams* may use raw and post-processed materials to build their *Robots*, provided these materials are readily available to all *Teams* (for example, McMaster-Carr, Home Depot, Grainger, AndyMark, TETRIX/PITSCO, MATRIX/Modern Robotics, REV Robotics, etc.).

Examples of allowed raw materials are:

- Sheet goods
- Extruded shapes
- Metals, plastics, wood, rubber, etc.
- Magnets

Examples of allowed post-processed materials are:

- Perforated sheet and diamond plate
- Injection molded parts
- 3D printed parts
- Cable, string, rope, filament, etc.
- Springs of all types: compression, extension, torsion, surgical tubing, etc.

<RM02> Commercial Off-The-Shelf Parts - *Teams* may use Commercial Off-The-Shelf (COTS) mechanical parts that have a single degree of freedom. For the *FIRST* Tech Challenge, a single degree of freedom part uses a single input to create a single output. The following are examples of single degree of freedom parts:

- Linear Actuator: a single rotary input results in a single direction linear output
- Pully: rotates around a single axis
- Single Speed Gearbox: a single rotary input results in a single rotary output

It is the intent of *FIRST* to encourage *Teams* to design their own mechanisms rather than buying pre-designed and pre-manufactured solutions to achieve the game challenge. Purchased mechanism kits (for example, grippers) that violate the single degree of freedom rule, either assembled or requiring assembly, are not allowed.

Examples of allowed COTS parts:

- Linear Slide Kit
- Linear Actuator Kit
- Single Speed (non-shifting) Gearboxes
- Pulley
- Turntable
- Lead Screws

Examples of illegal multiple degrees of freedom COTS parts:

- Gripper Assemblies or Kits
- Ratcheting Wrenches

Exceptions to the single degree of freedom rule <RM02> are:

- COTS drive chassis (for example, AndyMark TileRunner, REV Mecanum Drivetrain Kit, TETRIX Flex-Build Robot Chassis, etc.) are allowed provided none of the individual parts violate any other rules.

- Holonomic wheels (omni or mecanum) are allowed.
- Dead-wheel Odometry Kit – a combination of an encoder, a free-spinning omnidirectional wheel, an optional tensioner, and an enclosure used to accurately measure the wheel's rotation.

<RM03> Modifying Materials and COTS Parts - Allowed materials and legal COTS parts may be modified (drilled, cut, painted, etc.), as long as no other rules are violated.

<RM04> Allowed Assembly Methods - Welding, brazing, soldering, and fasteners of any type are legal methods for assembling a *Robot*.

<RM05> Lubricant - Any COTS lubricant is allowed, if it does not contaminate the *Playing Field*, scoring elements or other *Robot*s.

<RM06> Current Season Game and Scoring Elements - The following season game and scoring elements are not allowed for *Robot* construction:

a) COTS current or previous season's scoring elements.
b) Team manufactured replicas of COTS current or previous season's scoring elements.
c) *AprilTag* or fiducial images of any type are not allowed.

7.3.3 *Robot* Electrical Parts and Materials Rules

There are many possible ways to build and wire a *Robot*. These rules provide specific requirements on what is and is not allowed. *Teams* must ensure that electrical and electronic devices are used consistently with manufacturer's requirements and specifications. *Teams* are encouraged to review the *FIRST* Tech Challenge Robot Wiring Guide for suggestions on how to build a *Robot* with safe and reliable wiring.

<RE01> Main Power Switch - Exactly one *Robot* main power switch must control all power provided by the *Robot* main battery pack. *FIRST* requires *Teams* to use either the TETRIX (part # W39129), MATRIX (part # 50-0030), REV (REV-31-1387), or AndyMark (am-4969) power switch. This is the safest method for *Teams* and field personnel to shut down a *Robot*.

> Beginning in the 2024-2025 competition season, the MATRIX (part #50-0030) power switch will no longer be allowed.

The *Robot* main power switch must be mounted or positioned to be readily accessible and visible to field personnel. A main *Robot* Power label must be placed near the main power switch of the *Robot*. Attach the image ("POWER BUTTON") to your *Robot* near the main power switch. To be easily seen by field personnel the label should be at least 1 in x 2.63 in (2.54 cm x 6.68 cm, Avery Label # 5160) and placed on a flat surface (not wrapped around corners or cylinders).

A secondary *Robot* power switch downstream from the main power switch is allowed. It is recommended that the secondary power switch be labeled as a secondary switch in a manner dissimilar to the *Robot* Main Power Switch. The secondary switch must be one of the four allowed power switches specified in this rule.



> The *Robot* main power switch should be mounted on the *Robot* so it is protected from *Robot*-to-*Robot* contact to avoid inadvertent actuation or damage.

<RE02> Battery Mount - Batteries must be securely attached (for example, VELCRO, hook and loop strips, cable ties, rubber band) to the *Robot* in a location where they will not make direct contact with other *Robot*s or the *Playing Field*. Batteries should be protected from contact with sharp edges and protrusions (screw heads, screw ends, etc.)

<RE03> *Robot* Main Battery – All *Robot* power is provided by exactly one (1) 12V *Robot* main battery. The *Robot* main battery must include a replaceable in-line 20A fuse. Only one (1) of the approved battery packs is allowed on the *Robot*.

The only allowed *Robot* main power battery packs are:

a. TETRIX (W39057, formally 739023) 12V DC battery pack

b. Modern Robotics/MATRIX (14-0014) 12V DC battery pack

c. REV Robotics (REV-31-1302) 12V DC Slim Battery pack

> Note: There are similar looking batteries available from multiple sources, but the ONLY legal batteries are those listed above.

<RE04> Fuses - Fuses must not be replaced with fuses of higher rating than originally installed or according to manufacturer's specifications; fuses may not be shorted out. Fuses must not exceed the rating of those closer to the battery. If necessary, a fuse may be replaced with a smaller rating. Replaceable fuses must be single use only; self-resetting fuses (breakers) are not allowed.

<RE05> Electronics Power – Electronics power is constrained by the following:

a. The 12V *Robot* main battery, with the exception of power extension wire, must connect only to the *Robot* main power switch. The *Robot* main power switch regulates 12V power to the rest of the *Robot*. It is recommended to keep the path between the *Robot* main battery and *Robot* main power switch as short as possible using the largest possible diameter of wire.

b. Only the following electronic devices may be connected to 12V power, either by connecting directly to the *Robot* main power switch, a pass-through power connector on a *REV Control Hub* or *REV Expansion Hub*, or a power distribution block:

   i. REV Control Hub

   ii. REV Expansion Hub

   iii. REV Servo Power Module

   iv. REV SPARKmini Motor Controller

   v. Power distribution blocks (for example, REV XT30 Power Distribution Block, et. al.)

   vi. Voltage/Current Sensors

   vii. 12V Input Power LED controller/driver (for example. REV Blinkin LED Driver)

   It is highly recommended to keep the path between the *Robot* main power switch and the *REV Control Hub* and/or *REV Expansion Hub(s)* as short as possible using the largest possible diameter of wire.

c. Allowed sensors are only powered by the *REV Expansion Hub* or *REV Control Hub* via analog, digital, encoder, or I2C ports per <RE11>.

d. *Vision Cameras* must be connected directly to a *REV Control Hub,* or to the *Robot* control system

through a powered USB hub per <RE13>.

e. LEDs and other light sources must be powered per <RE12>.

f. The smartphone *Robot Controller Android Device* must be powered by its own internal battery or by the built-in charging feature of the *REV Expansion Hub*; external power is not allowed.

<RE06> *Robot Controller* – Exactly one (1) *Robot Controller* is required. The *Robot Controller* must be the only source of control for the *Robot.* A *Robot Controller* is comprised of:

a. A *REV Control Hub*; or

b. An allowed smartphone *Android Device* connected to a *REV Expansion Hub*

In addition to "a" or "b" above, a *Robot* may also contain:

c. No more than one additional *REV Expansion Hub*

d. Any quantity of *REV SPARKmini Motor Controllers*

e. Any quantity of *REV Servo Power Modules*

Important Note: The *Robot Controller* contains a built-in wireless radio that communicates with the *Android Device* in the *Driver Station*. The *Robot Controller* should not be obscured by metal or other material that could block or absorb the radio signals from the *Robot Controller*.

> Android smartphones will no longer be allowed to be used as part of the *Robot Controller* in the 2024-2025 season. The only legal *Robot Controller* will be the *REV Control Hub*.

<RE07> *Android Devices* – The only allowed *Android Devices* are:

Smartphones*:

a. Motorola Moto G4 Play (4th Generation)/Motorola Moto G4 Play†**

b. Motorola Moto G5

c. Motorola Moto G5 Plus

d. Motorola Moto E4 (USA versions only, includes SKUs XT1765, XT1765PP, XT1766, and XT1767)

e. Motorola Moto E5 (XT1920)

f. Motorola Moto E5 Play (XT1921)

Other:

g. *REV Driver Hub* may only be used as part of the *Driver Station.*

h. *REV Control Hub* may only be used as part of the *Robot Controller* and not as the *Driver Station*.

†The use of smartphones operating on Android version 6.x (Marshmallow) are no longer allowed in the 2023-2024 season. Android smartphones must use Android 7 (Nougat) or newer to be compatible with the current season's software minimum. The Moto G4 Play is no longer supported by over-the-air updates, and devices

that have not yet been updated to Android 7 (Nougat) may be unable to update. Certain models might be able to be updated by the Motorola Rescue and Smart Assistance Tool, but there are no guarantees.

*A smartphone *Android Device Robot Controller* USB interface may only connect to a *REV Expansion Hub*, or a USB hub.

**The Motorola Moto G4 Play may be sold as either Motorola Moto G Play (4th gen)", or "Motorola Moto G4 Play". Either phone is acceptable however *FIRST* Tech Challenge highly recommends that *Teams* purchase either model number XT1607 or XT1609, as these are the US versions and have been tested and are fully compatible with the *FIRST* Tech Challenge software. *Teams* that have purchased phones with model numbers XT1601, XT1602, XT1603, or XT1604 may continue to use these phones as legal, however there is a potential for issues with these phones not being fully compatible with the software or the approved gamepads.

<RE08> Motor and Servo Controllers – The only allowed motor and servo controllers are: *REV Expansion Hub*, *REV Control Hub*, *REV Servo Power Module*, *REV SPARKmini Motor Controller,* and *VEX Motor Controller 29*.

<RE09> DC Motors – A maximum of eight (8) DC motors are allowed in any combination. The only allowed motors are:

a. TETRIX 12V DC Motor

b. AndyMark NeveRest series 12V DC Motors

c. Modern Robotics/MATRIX 12V DC Motors

d. REV Robotics HD Hex 12V DC Motor

e. REV Robotics Core Hex 12V DC Motor

No other DC motors are allowed.

<RE10> Servos – A maximum of twelve (12) servos are allowed. Any servo that is compatible with the attached servo controller is allowed. Servos may only be controlled and powered by a *REV Expansion Hub, REV Control Hub,* or *REV Servo Power Module*. Servos may be rotary or linear but are limited to 6V or less. All servos must have a three-wire servo connector compatible with the *REV Control Hub* and *REV Expansion Hub* servo ports and may also have an optional additional sensor position output interface.

The VEX EDR 393 motor is considered a servo for the purposes of actuator allocation. It must be used in conjunction with a *VEX Motor Controller 29* and a *REV Servo Power Module.* A maximum of two (2) VEX EDR 393 Motors per *REV Servo Power Module* is allowed.

<RE11> Sensors - Sensors are subject to the following constraints:

a. Compatible sensors from any manufacturer may only be connected to the I2C, digital I/O, encoder, and analog ports of the *REV Expansion Hub* or *REV Control Hub*.

b. Compatible sensors from any manufacturer may be connected to the *Logic Level Converter* and/or the *I2C Sensor Adapter Cable*. Refer to Rule <RE14.j> for details on the use of *Logic Level Converter* and the *I2C Sensor Adapter Cable*.

c. Passive electronics may be used as recommended by sensor manufacturers at the interfaces to the sensors.

d. Voltage and/or current sensors are allowed, including between the main power switch and the *REV Expansion Hub* or *REV Control Hub,* except on an output port of a motor or servo controller.

e. Simple I2C multiplexers are allowed, and they may only be connected to and powered from the I2C connections available on *REV Expansion Hub* or *REV Control Hub*.

f. COTS I2C to SPI protocol converters are allowed as long as they are nonprogrammable. They may only be connected to and powered from the I2C connections available on the *REV Expansion Hub* or *REV Control Hub*.

<RE12> Light Sources – Functional and/or decorative light sources (including LEDs) are allowed with the following constraints:

a. Light sources may not interfere with or distract other *Robot* operations, *Team* members, volunteers, and spectators.

b. Lasers are not allowed unless they meet all of the following criteria:

   i. Must be part of a legal sensor as defined by <RE11>

   ii. Class 1 laser

   iii. Non-visible spectrum

c. Light-sources may be controlled by the following compatible ports on the *REV Expansion Hub* or *REV Control Hub*:

   i. Digital I/O

   ii. I2C

   iii. Motor Output

   iv. Servo Ports

d. Commercial Off the Shelf (COTS) interface modules designed to solely control light sources are allowed between the light sources and the components listed in <RE12>c.

e. The only approved power sources for lights are as follows:

   i. Internal (as supplied by the COTS manufacturer) battery pack or battery holder,

   ii. COTS USB external battery pack

   iii. Ports on a *REV Control Hub* or *REV Expansion Hub*, including:

      i. Motor-control ports

      ii. Encoder ports,

      iii. XT30 ports,

      iv. Servo ports,

      v. 5V auxiliary power ports,

      vi. I2C sensor ports,

      vii. Digital ports, and

      viii. Analog ports.

iv. Power distributed off of the 12V main power per <RE05>

f. Integrated light sources within otherwise legal devices are permitted (for example, status and power LEDs on legal USB cameras).

> The common rates to trigger seizures is between 3 and 30 hertz (flashes per second) but varies from person to person. While some people are sensitive to frequencies up to 60 hertz, sensitivity under 3 hertz is not common. Please keep in mind that event attendees could have sensitivities to flashing lights. [1]
>
> For example, *Teams* may signal via LED light that they have a scoring element ready. *Teams* that choose to use flashing lights should install lights that the flash rate is 1 hertz (in other words, cannot change states more frequently than approximately once a second) or less. If *Teams* have LED's that flash more frequently, they may be asked to turn them off.
>
> *Teams* that choose to install flashing lights should ensure the lights can be turned either completely off or on (not flashing). Head Referees have the discretion of asking *Teams* to turn their lights to either state if an event attendee or participant has a sensitivity to flashing lights.

[1] See https://www.epilepsysociety.org.uk/photosensitive-epilepsy#.XuJbwy2ZPsE accessed on 5/04/2023

<RE13> Video Cameras

a. Self-contained video recording devices (GoPro or similar) are allowed providing they are used only for non-functional post-*Match* viewing and the wireless capability is turned off. Approved self-contained *Video Cameras* must be powered by an internal battery (as supplied by the manufacturer).

b. *Vision Sensors* and *Vision Cameras* are allowed for computer vision related tasks.

   i. *Vision Sensors* must follow all sensor rules in <RE11>.

   ii. *Vision Cameras* must be UVC Compatible and must connect directly to a *REV Control Hub* via USB or to the *Robot Controller* through a powered USB hub.

   iii. Only single image sensor devices are allowed (stereoscopic cameras are not allowed).

<RE14> *Robot* Wiring - *Robot* wiring is constrained as follows:

a. USB surge protectors connected to USB cables are allowed.

b. Ferrite chokes (beads) on wires and cables are allowed.

c. A *Mini USB to OTG (On-The-Go) Micro Cable* or any combination of a *Mini USB* cable, a *USB hub,* and an *OTG Micro Adapter may be* used to connect the smartphone *Robot Controller Android Device* to the *Robot* electronics. Note that the *OTG Micro Adapter* may be integrated into the USB hub. These devices may connect to the *Robot* electronics in the following ways:

   i. Built-in USB input port of the *REV Expansion Hub or*

   ii. A USB hub that connects to the built-in USB input port of the *REV Expansion Hub*. If a powered hub is used, it must draw its energy from either:

      i. A COTS USB battery pack, or

      ii. A 5V auxiliary power port on a *REV Expansion Hub* or *REV Control Hub*.

d. Anderson Powerpole, XT30, and similar crimp or quick-connect style connectors are recommended for joining electrical wires throughout the *Robot*. Power distribution blocks or splitters are recommended where appropriate to reduce wiring congestion. All connectors and distribution blocks or splitters should be appropriately insulated.

e. Installed connectors (such as battery-pack connectors, battery charger connectors) may be replaced with Anderson Powerpole, XT30, or any compatible connector.

f. *Team* managed power and motor control wires must use consistent color-coding with different colors used for the positive (red, white, brown, or black with a stripe) and negative/common (black or blue) wires.

g. Wire and cable management products of any type are permitted (for example, cable ties, cord clips, sleeving, etc.).

h. Wire insulation materials of any type are permitted when used to insulate electrical wires or secure motor control wires to motors (for example, electrical tape, heat shrink, etc.).

i. Manufacturer supplied power, motor, servo, encoder, light sources, and sensor lead wires may be extended or modified using custom made or COTS wire extensions subject to the following constraints:

    i. Power wires are 18 AWG or larger diameter (for example, 16 AWG wire has a larger diameter than 18 AWG wire).

    ii. Motor control wires as follows:

        i. 22 AWG or larger diameter for TETRIX Max 12V DC motors and REV Robotics Core Hex (REV-41-1300) 12V DC motors

        ii. 18 AWG or larger diameter for all other 12V DC motors

    iii. PWM (servo) wires should be the same size or larger diameter than the original wiring or as specified by the manufacturer. If the original servo wire size is unknown, 22 AWG or larger diameter wire extensions are recommended.

    iv. Sensor wires should be the same size or larger diameter than the original wiring or as specified by the manufacturer.

> *Teams* should be prepared during *Robot* inspection to show documentation confirming the wire gauges used, particularly for multi-conductor cables.

    v. LED light source wires should be the same size recommended by the manufacturer or larger diameter. If the manufacturer does not specify a recommended size and the LED or strip has wires attached, use the same size or larger as provided by the manufacturer. If there are no attached wires and no recommended size is provided, use the following guidance:

        i. 5V LEDs - 22AWG or larger

        ii. 12V LEDs - 18AWG or larger

j. *Logic Level Converters – Logic Level Converters* that are used to connect a *REV Expansion Hub* or *REV Control Hub* to a 5V-compatible I2C sensor or a 5V-compatible digital sensor are allowed. Exactly one *Logic Level Converter* per I2C device and one *Logic Level Converter* per digital sensor are

allowed. A *Logic Level Converter* should only draw power from the *REV Expansion Hub* or *REV Control Hub*.

k. Electrically grounding the control system electronics to the frame of the *Robot* is recommended and only permitted using a *FIRST*-approved, commercially manufactured resistive grounding strap. The only resistive grounding strap approved for use is the REV Robotics resistive grounding strap (REV-31-1269). *Teams* that have electronics with Powerpole-style connectors must use the REV Robotics Anderson Powerpole to XT30 adapter (REV-31-1385) in conjunction with the REV Robotics resistive grounding strap. No other grounding straps or adapters are permitted. For additional details on installation of the grounding strap or adapter, please see the Robot Wiring Guide.

<RE15> Modifying Electronics - Approved electrical and electronic devices may be modified to make them more usable; they may not be modified internally or in any way that affects their safety.

Examples of modifications that are allowed:

- Shortening or extending wires
- Replacing or adding connectors on wires
- Shortening motor shafts
- Replacing gearboxes and/or changing gears

Examples of modifications that are **not** allowed:

- Replacing an H-Bridge in a motor controller
- Rewinding a motor
- Replacing a fuse with a higher value than specified by the manufacturer
- Shorting out a fuse

<RE16> Additional Electronics – Electronic devices that are not specifically addressed in the preceding rules are not allowed. A partial list of electronics that are not allowed includes: Arduino boards, Raspberry Pi, relays, electromagnets, and custom circuits.

7.3.4 *Driver Station* Rules

Teams provide their own *Driver Station,* and it must comply with the following constraints:

<DS01> *Driver Station* Controller – The *Driver Station* must consist of no more than one (1) of the following options:

a. One (1) smartphone *Android Device* listed in rule <RE07>, or

b. One (1) *REV Driver Hub.*

<DS02> *Driver Station* Controller Touch Screen - The touch display screen of the *Driver Station* Controller must be accessible and visible by field personnel.

<DS03> Gamepad – The *Driver Station* must contain no more than two (2) of the following gamepads in any combination:

a. Logitech F310 gamepad (Part# 940-00010)

b. Xbox 360 Controller for Windows (Part# 52A-00004)

c. Sony DualShock 4 Wireless Controller for PS4 (ASIN # B01LWVX2RG) operating in wired mode only (i.e., connected through USB 2.0 Type A to Type B Micro cable without being Bluetooth paired to any

device)

d. Sony DualSense Wireless Controller for PS5 (ASIN # B08FC6C75Y) operating in wired mode only (i.e., connected through USB 2.0 Type A to Type C cable without being Bluetooth paired to any device). This *DOES NOT* include the Sony DualSense Edge Wireless Controller in any configuration.

e. Etpark Wired Controller for PS4 (ASIN # B07NYVK9BT).

f. Quadstick game controller in Xbox 360 Emulation Mode (any model).

Mechanical enhancements to the gamepad that do not involve opening the gamepad or modifying the electronics are legal.

Different color gamepads are allowed provided they are the same model as the allowed gamepad.

<DS04> USB Hub – No more than one (1) external battery powered or unpowered USB hub is allowed.

<DS05> Charging the *Driver Station Controller* at the *Playing Field* – One (1) optional COTS USB external battery is allowed to charge the *Driver Station Controller*. The USB battery connects to the *Driver Station* Controller only by these methods:

a. Through the built-in USB-C port on the *REV Driver Hub.*

b. Through a USB Hub connected to the smartphone *Android Device*.

<DS06> Smartphone *Android Device* (if used) Additional Constraints –

a. One (1) OTG Cable is required

b. The *Driver Station* smartphone *Android Device* USB interface may only connect to either:

   i. A *Mini USB to OTG* (On-The-Go) cable or combination of cables connected to a USB Hub, or

   ii. One (1) gamepad, USB cable, and an *OTG Micro Adapter*.

<DS07> *Driver Station* Carrier – A *Team* is allowed to bring one (1) *Driver Station* carrier to the *Playing Field*. The *Driver Station* carrier's intended use is for organizing and transporting *Driver Station* components. *Driver Station* carrier constraints are as follows:

a. *Driver Station* carrier may not damage *Competition* provided equipment, the *Playing Field*, or the venue floor.

b. Decorative electronics (including LEDs) are allowed, and they must be powered by a 12V or lower COTS DC battery. The smartphone *Android Device* and *REV Driver Hub* may not power or control decorative electronics.

c. Non-decorative electronics are not allowed.

d. The *Driver Station* carrier must not be a distraction to gameplay, field personnel, *Teams*, or spectators.

The intent of this rule is to allow *Teams* to use a container to store, organize, and transport the *Driver Station* components. The *Driver Station* carrier rule is not intended to allow carriers that function as a *Robot* cart or replace a *Competition* provided *Driver Station* stand, table, etc.

Important Note: The *Driver Station* is a wireless device with a built-in wireless radio. During a *Match*, the *Driver Station* should not be obscured by metal or other material that could block or absorb the radio signals from the *Driver Station*.

<DS08> Driver Station Sounds – *Team* initiated sounds via *Team* code and sounds not generated by the official *Driver Station* app are not allowed to be played through the *Driver Station Android Device* at any official *Competition*.

> The intent of this rule is to prevent sounds that may distract gameplay. Android operating system power up sounds are not subject to this rule.

7.3.5 *Robot* Software Rules

For software resources and troubleshooting guides, please visit our website: https://www.firstinspires.org/resource-library/ftc/technology-information-and-resources.

<RS01> *Android Device* Names - Each *Team* MUST "name" their *Robot Controller Android Device* Wi-Fi name with their official *FIRST* Tech Challenge *Team* number and –RC (for example, "12345-RC"). Each *Team* MUST "name" their *Driver Station Android Device* with their official *Team* number and –DS (for example, 12345-DS). *Teams* with more than one *Driver Station* or *Robot Controller Android Device* must name these devices with the *Team* number followed by a hyphen then a letter designation beginning with "A" (for example, "12345-A-RC", "12345-B-RC").

<RS02> Recommended Programming Tools – Java is the recommended programming language for the *Robot Controller*. The following tools are recommended for use in the *FIRST* Tech Challenge:

a. FTC Blocks Development tool – a visual, blocks-based programming tool hosted by the *Robot Controller*.

b. FTC OnBot Java Programming tool – a text-based integrated development environment hosted by the *Robot Controller*.

c. Android Studio – a text-based integrated development environment.

d. Java Native Interface (JNI) & Android Native Development Kit (NDK) – *Teams* can incorporate native code libraries into their apps using the JNI framework and the Android NDK.

<RS03> Allowed Software System Versions - The following table lists the *Android Devices*, minimum Android versions, minimum operating system and firmware versions, and minimum FTC software versions allowed per device.

Android Smartphones		
Device	**Minimum Android Version**	**Minimum FTC Software Version**
Motorola Moto G4 Play (4th Generation) / Motorola Moto G4 Play (See <RE07> for details)	7.0 (Nougat)	9.0
Motorola Moto G5	7.0 (Nougat)	
Motorola Moto G5 Plus	7.0 (Nougat)	
Motorola Moto E4 (USA versions only, includes SKUs XT1765, XT1765PP, XT1766, and XT1767)	7.0 (Nougat)	
Motorola Moto E5 (XT1920)	7.0 (Nougat)	
Motorola Moto E5 Play (XT1921)	7.0 (Nougat)	

REV Hubs			
Device	**Minimum Software**	**Minimum Firmware Version**	**Minimum FTC Software Version**
REV Control Hub	Control Hub OS 1.1.2	Firmware 1.8.2	*Robot Controller* 9.0
REV Expansion Hub		Firmware 1.8.2	
REV Driver Hub	Driver Hub OS 1.2.0		*Driver Station* 9.0
Note: The REV Hardware Client software can be used to install software onto the REV Hubs.			

IMPORTANT: Rules <RS02> or <RS03> do not require that *Teams* upgrade to the latest version of the software. A mandatory upgrade (announced by *FIRST*) would only be required if *FIRST* determined there was a critical software fix that must be adopted by *Teams*. *Teams* must install the upgrade before the time of *Competition*. Additionally, beta versions of the software are allowed at official *Tournaments*. Mandatory upgrades will be communicated in the following ways:

- Via *Team* Blast – The mandatory upgrade and version number will be communicated to *Teams* on the *Team* Blast, which will also show the date the required upgrade must be made.
- Online – the minimally required software will be listed on our Technology Resources page, with the date *Teams* are required to make the mandatory software upgrade.
- Forum – The minimally required software will be listed in the Technology Forum page, with the date *Teams* are required to make the mandatory software upgrade.

Templates for all programming choices are available through the links located at http://www.firstinspires.org/node/5181.

<RS04> *Autonomous* to *Driver-Controlled* Transition - *Teams* that expect to operate their *Robot* during the *Autonomous* period must demonstrate during Field Inspection that the *Drive Team* can use the *Driver Station* to switch the *Robot Controller* between *Autonomous* mode and *Driver-Controlled* mode.

<RS05> *Robot Controller* App - The *Robot Controller* smartphone *Android Device* (if used) must have a designated "FTC *Robot Controller"* app that is the default application for the *REV Expansion Hub.* The *Robot Controller* app must not be installed on the *Driver Station Android Device*.

<RS06> *Driver Station* App – *Teams* must install the official "FTC *Driver Station"* app onto their *Driver Station Smartphone Android Device* or *REV Driver Hub* and use this app to control their *Robot* during a *Match*. The *Driver Station* FTC software version number must match the version number of the *Robot Controller* app. The *Driver Station* App must not be installed on the *Robot Controller Android Device*.

IMPORTANT: Rules <RS05> or <RS06> may require initial installation of the software, or updates throughout the season. *Teams* receiving the *REV Driver Hub* or *REV Control Hub* for the first time should install the most recent version of the software.

For initial installation or to install the most current version the software, please visit the following link: https://docs.revrobotics.com/control-hub/managing-the-control-system/rev-hardware-client

If updates to the SDK software are required, *Teams* will be notified in the following ways:

- Via *Team* Blast – The mandatory upgrade and version number will be communicated to *Teams* on the *Team* Blast, which will also show the date the required upgrade must be made.
- Online – the minimally required software will be listed on our Technology Resources page, with the date *Teams* are required to make the mandatory software upgrade.
- Forum – The minimally required software will be listed in the Technology Forum page, with the date *Teams* are required to make the mandatory software upgrade.

<RS07> *Smartphone Android Device*, *REV Driver Hub*, and *REV Control Hub* Operating System Settings - The *Robot Controller* and *Driver Station* must be set to:

a. Airplane mode must be turned on (does not apply to the *REV Control Hub* and *REV Driver Hub*).

b. Bluetooth must be turned off.

c. Wi-Fi must be turned on.

d. *REV Control Hub* password must be different than the factory default value of "password".

<RS08> Software Modification –

a. *Teams* are not allowed to modify the *FIRST* Tech Challenge *Driver Station* app in any fashion.

b. *Teams* are required to use the *FIRST Robot Controller* SDK, and are not allowed to remove, replace, or modify the portions of the SDK which are distributed as binary .AAR files.

The intent of this rule is for *Teams* to download the official version of the SDK from *FIRST* and make modifications to add *Team* created code.

Reengineered, reverse engineered, or modified versions of the official *FIRST* SDK are not allowed.

<RS09> *Driver Station* Communication - Communication between the *Robot* and *Driver Station* is only allowed via the *Robot Controller* and *Driver Station* applications.

Communication between the *Robot Controller* and the *Driver Station* is limited to the unmodified mechanisms provided by the official *FIRST* Tech Challenge (FTC) software, which consists of the official FTC Software Development Kit (SDK), the FTC *Robot Controller* app, and the FTC *Driver Station* app. *Teams* are not permitted to stream audio, video or other data using third-party software or modified versions of the FTC software. *Teams* may only use the unmodified telemetry feature included with the FTC software to transfer

additional data between the *Robot Controller* and the *Driver Station*. Software that is preinstalled by an approved smartphone's manufacturer and cannot be disabled is exempt from this constraint.

During a *Match*, a *Team's Robot Controller* and a *Team's Driver Station* are not allowed to be connected wirelessly to any other device besides each other.

<RS10> *Robot Controller* Sounds - *Team* initiated sounds via *Team* code and sounds not generated by the official *Robot Controller* app are not allowed to be played through the *Robot Controller Android Device* at any official *Competition*.

> The intent of this rule is to prevent sounds that may distract gameplay. Android operating system power up sounds are not subject to this rule.

7.4 Team Game Element

The *Team* game element is an optional *Team* designed and manufactured game element that will be used in the CENTERSTAGE℠ game. The *Team* game element must pass inspection before it is allowed to be used in a *Match*.

The *Team* game element construction rules will be released on 9-9-2023.

7.5 Team Scoring Element Construction Rules

The *Team Scoring Element* is an optional *Team* designed and manufactured scoring element that will be used in the CENTERSTAGE℠ game. The *Team* scoring element must pass inspection before it is allowed to be used in a *Match*.

The *Team* scoring element construction rules will be released on 9-9-2023.

8.0 Inspection

8.1 Description

Teams are highly recommended to conduct a *Robot* and field self-inspection prior to competing. These inspections will ensure that all *Robot* rules and regulations are met. The official "*Robot* and Field Inspection" checklists are located in Appendices B and C.

9.0 Judging and Award Criteria

9.1 Overview

This section provides descriptions of:

- *Engineering Portfolio* requirements and recommendations
- How judging works
- *FIRST* Tech Challenge award criteria

Teams have spent a significant number of hours designing, building, programming their *Robot*, and learning what it takes to be part of a *Team*. For many *Teams*, the event is the reward for all their hard work throughout the season. While there are several types of events, they all offer a fun and exciting way for *Teams* to show the results of their efforts.

The judged awards give us the opportunity to recognize *Teams* who embody important values like *Gracious Professionalism*®, teamwork, creativity, innovation, and the value of the engineering design process. These judging guidelines are a part of the road map to success.

FIRST Tech Challenge provides judging feedback for *Teams* who submit a completed judging feedback request form. When receiving feedback, *Teams* should note the judging is a subjective process; and *Students* are encouraged to learn the important life skill of self-evaluation to help them prepare for their judged interview. This helps *Students* prepare for professional interviews while developing other real-world life skills. For a copy of the *FIRST* Tech Challenge *Team* Judging Session Self-Reflection Sheet please visit the website: https://www.firstinspires.org/node/5226

9.1.1 Key Terms and Definitions

Engineering Notebook – Not required for award consideration, the *Engineering Notebook* is a thorough description of the *Team*'*s* experiences throughout the season. At events, a judge may ask to review this optional resource, but a *Team* will not be penalized if there is no *Engineering Notebook*.

Engineering Portfolio – Required for award consideration, the *Engineering Portfolio* is a document that does not exceed 15 pages that summarizes the most important accomplishments of the *Team*, in the *Team's* opinion. Guidelines for what must, should, and could be included for award consideration is listed in section 9.2.6.

Home Region – The default or manually assigned region that a *Team* is a part of. These are generally geographic in nature. Special considerations can be made, at the discretion of the program delivery partner and *FIRST* to move a *Team* to another region, or to add a *Team* with no program delivery partner to another *Home Region*. A *Team* can only be a part of one *Home Region*.

Team Information – The *Team* name, *Team* number, a photograph of the *Robot*, a photograph of the *Team* school or club information, the *Team* City and State, *Team* motto. Please do not include the full name of any student, coach, or mentor in the *Engineering Portfolio*.

CAD drawings, business plan information, award Information, accolades, *Team* size, *Team* goals, and other 'content' will be viewed as *Engineering Portfolio* content and is counted as a page in the portfolio.

Team Plan – Any descriptor of *Team* goals. This could include a strategic plan that references *Student* recruitment, sponsorship, mentor recruitment, outreach efforts, fundraising goals, or *Team* learning goals.

9.2 Engineering Portfolio

9.2.1 Overview
This section describes the requirements for creating the *Engineering Portfolio,* including formatting guidelines.

9.2.2 What is an Engineering Portfolio?
An *Engineering Portfolio* is a short and concise summary of the *Team*'*s* engineering journey throughout their season. The *Engineering Portfolio* should include sketches, discussions and *Team* meetings, design evolution, processes, obstacles, goals and plans to learn new skills, and each *Team* member's concise thoughts throughout the journey for the season, the *Engineering Portfolio* is like the *Team's* CV or resume.

One of the goals of *FIRST* and *FIRST* Tech Challenge is to recognize the engineering design process and the journey that a *Team* makes. This journey encompasses the phases of the problem definition, concept design, system-level design, detailed design, test and verification, and production of the *Robot*.

9.2.3 Engineering Portfolio Formats
Teams may choose to document their summary portfolio with either handwritten or electronic documents. There is no distinction made between handwritten and electronic *Engineering Portfolios* during judging; each format is equally acceptable.

a) Electronic: *Teams* may choose to use any electronic programs to create their *Engineering Portfolio*.
   - For remote event judging, *Teams* must create a single PDF file of their *Engineering Portfolio*.
   - For traditional events, *Teams* must print their *Engineering Portfolio*.

b) Handwritten: *Teams* can choose to create a handwritten version.
   - For remote event judging, this is discouraged due to difficulties in scanning into a readable, sharable, online version.

9.2.4 Engineering Portfolio Requirements
1. To be considered for judged awards, a *Team* **must** submit an *Engineering Portfolio*.
   a) *Teams* who do not submit an *Engineering Portfolio* will **not** be considered for judged awards.
2. The total number of pages for an *Engineering Portfolio* must not exceed 15 pages, plus a cover sheet for a total of 16 pages.
   a) Cover sheet may include the *Team Information* and a table of contents.
      i. Allowed *Team Information* is limited to *Team* number, *Team* name, *Team* location, *Team* school or organization, *Team* motto and an image of the *Robot* and/or the *Team*.
   b) Cover sheet may not include other *Engineering Portfolio* content.
      i. Additional content on the cover sheet adds to the page count of the portfolio, meaning content on the last page of the portfolio will not be reviewed or considered.
   c) Pages must be the equivalent of standard A sized paper (US 8.5 x 11) or Standard A4 sized paper (EU 210 x 297 mm).
   d) Fonts used must be a minimum of 10 points. Please avoid the use of narrow fonts, as they can be difficult for judges to read.

A *Team* number on the top of every page makes it easy for judges to know who created the *Engineering Portfolio* they are reviewing. The *Team* number on the front page is a required component of the *Engineering Portfolio*.

e) Judges are instructed to only review the cover sheet and the first 15 pages of content that follow the cover sheet. Information included beyond 15 pages and the cover sheet will **not** be reviewed or considered.

3. The *Engineering Portfolio* must **not** include links to other documents, videos, or any other additional content.
    a) Please note that judges will **not** review linked content in the *Engineering Portfolio*, including web sites, or videos.
4. The Control Award Submission Form is not a part of the *Engineering Portfolio* and is not included in the total *Engineering Portfolio* page count.

9.2.5 Engineering Portfolio Recommendations

1. We strongly recommend the *Team* number is at the top of each page.
2. The body of the *Engineering Portfolio* **could** include:
    a) Summary of the engineering content that includes the *Robot* design processes.
    b) Summary of the *Team Information* that includes information about the *Team* and outreach activities.
    c) Summary of the *Team Plan* and information about the *Team* overall. The *Team Plan* could be a business plan, a fund-raising plan, a strategic plan, a sustainability plan, or a plan for the development of new skills.

It is a good idea to connect the award criteria to specific content in your *Engineering Portfolio*!

9.2.6 Engineering Portfolio Requirements by Award

The chart below provides a quick outline of the *Engineering Portfolio* requirements by award:

Engineering Portfolio Requirements by Award **Requirements are indicated using the word "must," recommendations are indicated using words like "could" or "should."**	
Inspire Award	• *Team* **must** submit an *Engineering Portfolio*. The *Engineering Portfolio* **must** include summary information about the *Robot* design, information about the *Team*, and a *Team Plan*. The entire *Engineering Portfolio* **must** be high quality, thoughtful, thorough, concise, and well-organized. The *Engineering Portfolio* could inspire the judges to ask about specific information.
Think Award	• *Team* must submit an *Engineering Portfolio*. • The *Engineering Portfolio* **must** have engineering content. The engineering content **could** include entries describing examples of the underlying science, mathematics, and game strategies in a summary fashion. • The *Engineering Portfolio* **must** provide examples that show the *Team* has a clear understanding of the engineering design process including an example of lessons learned. • The portfolio **could** inspire the judges to ask about specific, detailed engineering information. • Portfolio format is less important but enables the judges to understand the *Team's* design maturity, organizational capabilities, and overall *Team* structure. • Portfolio **could** reference specific experiences and lessons learned

	but **should** capture the summary of the status of the *Team* and their *Robot* design. • Portfolio **could** summarize experiences and lessons learned from outreach with concise tables of outcomes. • Portfolio **could** summarize how they acquired new mentors and/or acquired new knowledge and expertise from their mentors. • Portfolio **could** contain a summary of overall *Team Plan*. • Portfolio **could** contain information about the plans to develop skills for *Team* members. • Portfolio **could** be organized in a logical manner.
Connect Award	• *Team* **must** submit an *Engineering Portfolio*. • Portfolio **must** include a *Team Plan*. The *Team Plan* could the *Team's* goals for the development of *Team* member skills, and the steps the *Team* has or will take to reach those goals. Other examples of what the plan could include are timelines, outreach to science, engineering, and math communities, and training courses. • Portfolio **must** include a summary of how they acquired new mentors or acquired new knowledge and expertise from their mentors.
Innovate Award sponsored by Raytheon Technologies	• *Team* **must** submit an *Engineering Portfolio*. • The *Engineering Portfolio* **must** include examples of the *Team's* engineering content that illustrate how the *Team* arrived at their design solution. • The portfolio **could** inspire the judges to ask about specific, detailed engineering information.
Control Award sponsored by Arm	• The *Team* **must** submit an *Engineering Portfolio*. The *Engineering Portfolio* **must** include engineering content that documents the control components. • The *Team* **must** submit a control award submission form as a separate document. *Teams* **should** identify the control aspects of their *Robot* that they are most proud of. • The Control Award submission form **must** not exceed 2 pages.
Motivate Award	• *Team* **must** submit an *Engineering Portfolio*. • The *Engineering Portfolio* **must** include a *Team* organization plan, which could describe their future goals and the steps they will take to reach those goals. Other examples of what the plan could include are *Team* identity, fund-raising goals, sustainability goals, timelines, outreach to non-technical groups, finances, and community service goals. • The *Team* is an ambassador for *FIRST* programs. • *Team* can explain the individual contributions of each *Team* member, and how these apply to the overall success of the *Team*.
Design Award	• *Team* **must** submit an *Engineering Portfolio* that includes examples of *Robot* CAD images or detailed *Robot* design drawings. • The portfolio **could** inspire the judges to ask about specific, detailed design engineering content.

9.3 Engineering Notebook

The *Engineering Notebook* is an optional item and could be used as a fundamental source of information for the *Team* to use to be able to create the *Engineering Portfolio*. The *Engineering Notebook* is one method of creating a documentation repository of the *Team*, outreach and fund-raising efforts, *Team Plans*, and the *Robot* design. This documentation can include sketches, discussions and *Team* meetings, design evolution, processes, and obstacles.

The *Engineering Notebook* is not used when considering a *Team* for judged awards.

9.4 Judging Process, Schedule, and Team Preparation

The schedules at the *FIRST* Tech Challenge *Competitions* may vary from event to event. At traditional events, judging interviews are scheduled for before the start of *Match* play. For remote events, judging will take place during a pre-determined window of time. Exact times for both the *Matches* and meeting with judges cannot be given within this manual. All *Teams* receive the schedule before or during check-in at the *Competition*, or in advance of their scheduled remote interview.

9.4.1 How Judging Works

At *FIRST* Tech Challenge *Competitions*, there will be four parts to the judging process:

1. Interview with the judges.
    a. *Teams* take part in scheduled, private interviews with a panel of two or more judges.
    b. *Teams* are asked to bring their *Robot* to the judge interview. This is the best chance for *Teams* to explain and show their *Robot* design to the judges in a quiet and relaxed environment. For remote events, *Teams* may show photos of their *Robot* to the judges as a part of their remote interview.
        i. *Teams* who have not built a *Robot* or have a *Robot* that has not passed *Robot* inspection are permitted to participate in judging and are eligible for consideration for all awards.
    c. The interview will last at least 10 minutes.
    d. During the first 5 minutes of the interview, *Teams* can present to the judges, without interruption.
        i. *Teams* are not required to prepare a presentation and will not be penalized if they do not have a prepared presentation.
        ii. *Teams* will not receive more than 5 minutes for their uninterrupted presentation.
        iii. *Teams* may not pre-record their presentation.
    e. At the five-minute mark, the judges will begin to ask questions of the *Team*.
2. *Match* observations by judges (traditional events only).
    a. Judges observe the *Robot*, *Student* interactions, and the *Gracious Professionalism*® of the entire *Team*.
3. Judges follow up with additional interviews in the pits during *Competition*. For remote events, this second interview will be pre-scheduled.
4. Evaluation of the *Engineering Portfolio*

All *Teams* are eligible to participate in the judging process. A *Robot*, a working *Robot*, or a *Robot* that has passed inspection is not a requirement to participate in judging.

No awards will be decided based on the judges' interview or *Engineering Portfolio* alone. Judges use the guidelines provided in this section to assess each *Team*.

Teams should present their *Engineering Portfolio*, their control award submission form, and their judging feedback request form to the judges at the start of their interview unless otherwise directed by the *Competition* officials. In remote events, the *Team* coach, as the *Team* admin, is designated to upload these materials to the FTC Scoring System.

After the judges review the submitted *Engineering Portfolio*, complete the scheduled *Team* interviews, and evaluate the *Team* and *Robot* performance on the field, they meet to review their assessments and create a list of top candidates for the various judged awards. Judges may require more discussion with *Teams*.

9.4.1.1 Feedback to Teams

Teams who wish to receive feedback from judges must submit a completed judging feedback request form.

Judges will conduct the *Team* interview and review the documentation submitted by the *Team*. After the event, the lead coach/mentor 1 for the *Team* will receive access to the judging feedback form which has been completed by the event judges.

The feedback form is completed by the judges immediately following the formal interview.

The feedback form is not used by the judges during their deliberation process.

9.4.1.2 Teams Without a Robot

Teams who have not built a *Robot* or have a *Robot* that has not passed *Robot* inspection are permitted to participate in judging and are eligible for award consideration.

9.4.2 Judging Schedule

The judging interviews take place in a separate area or room away from other *Teams* as well as the noise of the *Competition* and pit. *Teams* follow the schedule that outlines *Team* interview times and locations. Sometimes, *Teams* may receive this information in advance, but more often, *Teams* will receive this information when they check-in on the morning of the event. For remote events, *Team* coaches will receive the *Team's* judging schedule in advance of the event.

As much as possible, *Teams* should familiarize themselves with where and how judging will occur and allow enough time to get there. We expect that all *Teams* arrive at the judge queuing area five minutes before their scheduled judging interview. This helps us keep the event running on time.

9.4.3 Team Preparation

Teams are encouraged to read and understand the award requirements for each award to assess where they are within an award category and help them establish higher goals. These guidelines are the same ones used by the judges during each *Competition*, and at the *FIRST* championship. Please see the Award Categories section of this manual for award requirements and look over the *Engineering Portfolio* Requirements by Award to ensure the *Team's Engineering Portfolio* meets the criteria by award. *Teams* should attend judging workshops and judging practice days if they are available in their region. Practice makes for a better presentation, and practice in front of others could help a *Team* identify gaps in their presentation. Judging self-reflection sheets are another tool that *Teams* can use to prepare for their judging interview.

Teams may also read the Judge and Judge Advisor Manuals to gain more insight into the entire judging process.

During the *Team's* interview, the judges want to know highlights about the *Team*; what the *Team* learned during the *Competition* season; and the experiences that were gained. *Team* representatives' abilities to answer the questions or elaborate on *Robot* design functions or qualities are evaluated during the *Team* interview.

9.4.4 Coaches Involvement in Interviews

Check with the tournament director to see if mentors and coaches can watch the *Team* interview. Mentors and coaches may not contribute to the judging interviews. Mentors and coaches should always keep in mind that *FIRST* Tech Challenge is a *Student*-centered activity. It is about giving the *Students* a unique and stimulating experience in all aspects of the program.

9.4.4.1 Coaches Involvement in Interviews Exceptions

FIRST Tech Challenge will make exceptions for coaches who are needed to translate for *Students*, for coaches of *Students* with different abilities, and other exceptional circumstances. Please let the tournament director know in advance if your *Team* would like to be considered for an exception.

9.4.5 Video Award Submission Guidelines for Compass and Promote Awards

The submission process for this award may vary by *Competition*. The compass and promote awards are not offered at all events. Please check with the tournament director for details. Winning videos will be submitted to *FIRST* and used to promote the higher values of *FIRST* Tech Challenge. *Teams* can also send their promote videos directly to *FIRST*; however, these submissions will not be formally judged. If you would like to send your promote video to *FIRST*, please email firsttechchallenge@firstinspires.org with the subject line "Promote Award Video".

- The video must be submitted at least one week before *Competition* day. Instructions for submitting videos may vary from *Competition* to *Competition*. Please check with the tournament director for details.
- Videos must be submitted in AVI, WMV, MOV or better format. Submission through use of a streaming service such as YouTube is not acceptable. Remember the winning video may be shown on a large screen during the awards ceremony. *Teams* should use the best resolution available for the final version.
- Only one video submission per *Team* will be considered. *Teams* may submit new or updated videos at each *Competition*.
- *Teams* must have permission from the copyright owners for music used in the video and indicate this in their video.

9.5 Award Categories

9.5.1 Inspire Award

This judged award is given to the *Team* that best embodies the 'challenge' of the *FIRST* Tech Challenge program. The *Team* that receives this award is a strong ambassador for *FIRST* programs and a role model *FIRST Team*. This *Team* is a top contender for many other judged awards and is a gracious competitor. The Inspire Award winner is an inspiration to other *Teams*, acting with *Gracious Professionalism*® both on and off the *Playing Field*. This *Team* shares their experiences, enthusiasm and knowledge with other *Teams*, sponsors, their community, and the judges. Working as a unit, this *Team* will have shown success in performing the taskof designing and building a *Robot*.

Required Criteria for the Inspire Award:

- *Team* must show respect and *Gracious Professionalism*® to everyone they meet at a *FIRST* Tech Challenge event.
- *Team* must be a strong contender for several other judged awards. The Inspire Award celebrates the strongest qualities of all the judged awards.
- The *Team* must be an ambassador for *FIRST* programs. They demonstrate and document their work in their community.
- *Team* must be positive and inclusive, and each *Team* member contributes to the success of the *Team*.
- *Team* must submit an *Engineering Portfolio*. The *Engineering Portfolio* must include engineering content,*Team Information* and a *Team Plan*. The entire *Engineering Portfolio* must be high quality, thoughtful, thorough, concise, and well-organized.
- *Robot* design must be creative and innovative, and the *Robot* performs reliably on the *Field*. The *Team* communicates clearly about their *Robot* design and strategy to the judges.
- *Team* interview session must be professional and engaging.

Strongly Suggested Criteria for the Inspire Award:

- The *Team* should be able to share or provide more detailed information to support the information in the portfolio.
- The *Team* should refer to the Award Definitions for judging outlined in Appendix F for outreach and be able to provide supporting documentation to the judges, where applicable.

9.5.2 Think Award

Removing engineering obstacles through creative thinking.

This judged award is given to the *Team* that best reflects the journey the *Team* took as they experienced the engineering design process during the build season. The engineering content within the portfolio is the key reference for judges to help identify the most deserving *Team*. The *Teams* engineering content must focus onthe design and build stage of the *Team's Robot*.

The *Team* must be able to share or provide additional detailed information that is helpful for the judges. This could include descriptions of the underlying science and mathematics of the *Robot* design and game strategies, the designs, redesigns, successes, and opportunities for improvement. A *Team* is not a candidate for this award if their portfolio does not include engineering content.

Required Criteria for the Think Award:

- *Team* must show respect and *Gracious Professionalism*® to everyone they meet at a *FIRST* Tech Challenge event.
- *Team* must submit an *Engineering Portfolio*.
- *Engineering Portfolio* must have engineering content. The engineering content could include

entries describing examples of the underlying science, mathematics, and game strategies in a summary fashion.
- The *Engineering Portfolio* must provide examples that show the *Team* has a clear understanding of the engineering design process including examples of lessons learned.

Strongly Suggested Criteria for the Think Award:

- *Team* must be able to describe or provide additional information to the judges about their portfoliocontent.
- *Engineering Portfolio* could summarize how the *Team* acquired new mentors or acquired new knowledge and expertise from their mentors.
- *Engineering Portfolio* could contain summary of overall *Team Plan*.
- *Engineering Portfolio* could contain information about the plans to develop skills for *Team* members.
- Portfolio format is less important but enables the judges to understand the *Team's* design maturity, organizational capabilities, and overall *Team* structure.
- Portfolio could reference specific experiences and lessons learned but should capture the summary ofthe status of the *Team* and their *Robot* design.
- Portfolio could also summarize experiences and lessons learned from outreach with concise tables of outcomes.
- The *Team* should refer to the Award Definitions for judging outlined in Appendix F for outreach and be able to provide supporting documentation to the judges, where applicable.

9.5.3 Connect Award

Connecting the dots between community, *FIRST*, and the diversity of the engineering world.

This judged award is given to the *Team* that most connects with their local science, technology, engineering, and math (STEM) community. A true *FIRST Team* is more than a sum of its parts and recognizes that engaging their local STEM community plays an essential part in their success. The recipient of this award is recognized for helping the community understand *FIRST*, the *FIRST* Tech Challenge, and the *Team* itself. The *Team* that wins the Connect Award actively seeks and recruits engineers and explores the opportunities available in the world of engineering, science, and technology. This *Team* has a clear *Team Plan* and has identified steps to achieve their goals.

Required Criteria for the Connect Award:

- *Team* must show respect and *Gracious Professionalism*® to everyone they meet at a *FIRST* Tech Challenge event.
- *Team* must submit an *Engineering Portfolio*.
- Portfolio must include a *Team Plan* that covers the *Team's* goals for the development of *Team* member skills, and the steps the *Team* has taken or will take to reach those goals. Examples of what the plan could include are timelines, outreach to science, engineering, and math communities, and training courses.
- Portfolio must include a summary of how the *Team* acquired new mentors or acquired new knowledge and expertise from a mentor. Working with mentors from *FIRST*'s Mentor Matching site is an acceptable way to learn from mentors.

Strongly Suggested Criteria for the Connect Award:

- *Team* provides clear examples of developing in person or virtual connections with individuals in the engineering, science, or technology community.
- *Team* actively engages with the engineering community to help them understand *FIRST*, the *FIRST* Tech Challenge, and the *Team* itself.
- The *Team* should refer to the Award Definitions for judging outlined in Appendix F for outreach and

beable to provide supporting documentation to the judges, where applicable.

9.5.4 Innovate Award sponsored by Raytheon Technologies

Bringing great ideas from concept to reality.

The Innovate Award celebrates a *Team* that thinks imaginatively and has the ingenuity, creativity, and inventiveness to make their designs come to life. This judged award is given to the *Team* that has the most innovative and creative *Robot* design solution to any specific components in the *FIRST* Tech Challenge game. Elements of this award include elegant design, robustness, and 'out of the box' thinking related to design. Thisaward may address the design of the whole *Robot* or of a sub-assembly attached to the *Robot*. The creative component must work consistently, but a *Robot* does not have to work all the time during *Matches* to be considered for this award. The *Team's Engineering Portfolio* must include a summary of the design of the component or components and the *Team's Robot* to be eligible for this award. Entries must describe how the *Team* arrived at their solution.

Required Criteria for the Innovate Award sponsored by Raytheon Technologies:

- *Team* must show respect and *Gracious Professionalism*® to everyone they meet at a *FIRST* Tech Challenge event.
- *Team* must submit an *Engineering Portfolio*.
- The *Engineering Portfolio* must include examples of the *Team's* engineering content that illustrate how the *Team* arrived at their design solution.
- *Robot* or *Robot* sub-assembly must be creative, elegant, and unique in its design.
- Creative component must be stable, robust, and work reliably most of the time.

Strongly Suggested Criteria for the Innovate Award sponsored by Raytheon Technologies:

- The portfolio could inspire the judges to ask the *Team* about the specific detailed engineering information.

9.5.5 Control Award sponsored by Arm:

Mastering *Robot* intelligence.

The Control Award celebrates a *Team* that uses sensors and software to increase the *Robot's* functionality in the field. This award is given to the *Team* that demonstrates innovative thinking to solve game challenges such as *Autonomous* operation, improving mechanical systems with intelligent control, or using sensors to achieve better results. The control component should work consistently in the *Field*. The *Team's Engineering Portfolio* must contain a summary of the software, sensors, and mechanical control, but would not include copies of the code itself.

Required Criteria for the Control Award, sponsored by Arm:

- *Team* must show respect and *Gracious Professionalism*® to everyone they meet at a *FIRST* Tech Challenge event.
- *Team* must apply for the Control Award by filling out the Control Award Submission Form, located in Appendix E. The Control Award Submission Form must not exceed 2 pages.
- The *Team* must submit an *Engineering Portfolio*. The *Engineering Portfolio* must include engineering content that documents the control components.
- Control components must enhance the functionality of the *Robot* on the *Playing Field*.

Strongly Suggested Criteria for the Control Award, sponsored by Arm:

- Advanced software techniques and algorithms are encouraged, but not required.

- Control components should work reliably.
- Learnings from the *Team* about what they tried and what did not work with regards to sensors, hardware, algorithms, and code could be included in the *Engineering Portfolio*.

9.5.6 Motivate Award

Sparking others to embrace the culture of *FIRST*!

This *Team* embraces the culture of *FIRST* and clearly shows what it means to be a *Team*. This judged award celebrates the *Team* that represents the essence of the *FIRST* Tech Challenge *Competition* through *Gracious Professionalism* and general enthusiasm for the overall philosophy of *FIRST* and what it means to be a *FIRST* Tech Challenge *Team*. This is a *Team* who makes a collective effort to make *FIRST* known throughout their school and community, and sparks others to embrace the culture of *FIRST*.

Required Criteria for the Motivate Award:

- *Team* must show respect and *Gracious Professionalism*® to everyone they meet at a *FIRST* Tech Challenge event.
- *Team* must submit an *Engineering Portfolio*. The *Engineering Portfolio* must include a *Team* organization plan, which could describe their future goals and the steps they will take to reach those goals. Examples of what the plan could include are *Team* identity, fund-raising goals, sustainability goals, timelines, outreach, finances, and community service goals.
- The *Team* must be an ambassador for *FIRST* programs.
- *Team* must be able to explain the individual contributions of each *Team* member, and how these applyto the overall success of the *Team*.

Strongly Suggested Criteria for the Motivate Award:

- *Team* takes part in their presentation, and actively engages with the judges.
- *Team* shows a creative approach to materials that market their *Team* and *FIRST*.
- *Team* can clearly show the successful recruitment of people who were not already active within the STEM community.
- *Team* could also summarize experiences and lessons learned from outreach.
- The *Team* should refer to the Award Definitions for judging outlined in Appendix F for outreach and beable to provide supporting documentation to the judges, where applicable.

9.5.7 Design Award

Industrial design at its best.

This judged award recognizes design elements of the *Robot* that are both functional and aesthetic. The Design Award is presented to *Teams* that incorporate industrial design elements into their solution. These design elements could simplify the *Robot's* appearance by giving it a clean look, be decorative in nature, or otherwise express the creativity of the *Team*. The *Robot* should be durable, efficiently designed, and effectively address the game challenge.

Required Criteria for the Design Award:

- *Team* must show respect and *Gracious Professionalism*® to everyone they meet at a *FIRST* Tech Challenge event.
- *Team* must submit an *Engineering Portfolio* with engineering content. This could be CAD images or *Robot* drawings of the *Team's* overall design and/or components.
- *Team* must document and implement strong industrial design principles, striking a balance between form, function, and aesthetics.

Strongly Suggested Criteria for the Design Award:

- Distinguishes itself from others by its aesthetic and functional design.
- Basis for the design is well considered (that is inspiration, function, etc.).
- Design is effective and consistent with *Team Plan* and strategy.
- The portfolio could inspire the judges to ask the *Team* about specific detailed engineering information.

9.5.8 Promote Award (Optional)

This judged award is optional and may not be given at all *Tournaments*.

The Promote Award is given to the *Team* that is most successful in creating a compelling video message for the public designed to change our culture and celebrate science, technology, engineering, and math. *Teams* must submit a one-minute-long public service announcement (PSA) video based on the PSA subject for the season.

Team may win the Promote Award only once at a Championship level event and only once at a qualifying *Tournament* or league *Tournament* level event.

PSA Subject for 2023-2024 season:

"The best thing about *FIRST* Tech Challenge is…"

Required criteria for the Promote Award:

- Video must follow *FIRST* branding and design standards.
- Video cannot be longer than 60 seconds.
- Video must be of a high quality, as submissions may be used later to promote *FIRST*.
- *Team* must have rights to the music used in the video.
- Music and permissions must be listed in video credits.
- Video must have strong production value.
- Video must be submitted by the deadline given by the tournament director.
- *Team* must present a thoughtful and impactful video which appeals to the public.
- Creativity in interpreting the yearly theme is required.
- Follow video award submission guidelines.

9.5.9 Compass Award (Optional)

A beacon and leader in the journey of the *FIRST* Tech Challenge.

This judged award is optional and may not be given at all *Tournaments*.

The Compass Award recognizes an adult coach or mentor who has given outstanding guidance and support toa *Team* throughout the year and demonstrates to the *Team* what it means to be a *Gracious Professional*. The winner of the Compass Award will be chosen from candidates nominated by *FIRST* Tech Challenge *Student Team* members, via a 40-60 second video submission. The video must highlight how their mentor has helped them become an inspirational *Team*. We want to hear what sets the mentor apart.

Required criteria for the Compass Award:

- Video must follow *FIRST* branding and design standards.
- Video cannot be longer than 60 seconds.
- Video must be of a high quality, as submissions may be used later to promote *FIRST*.
- *Team* must have permission from the copyright owners for the music used in the video.
- Music and permissions must be listed in video credits.
- Video must be submitted by the deadline given by the tournament director.
- Video highlights the mentor's contribution to the *Team* and demonstrates what sets the mentor apart.

9.5.10 Judges' Choice Award
This award is optional and may not be given at all *Tournaments*.

During the *Competition*, the judging panel may meet a *Team* whose unique efforts, performance, or dynamics merit recognition, but does not fit into any of the existing award categories. To recognize these unique *Team*, *FIRST* offers a customizable Judges Choice Award. The judging panel may select a *Team* to be honored, as well as the name of the Judges Choice Award. The Judges Choice Award recognizes a *Team* for their outstanding efforts but does not factor into the advancement criteria.

9.5.11 Winning Alliance Award
This award will be given to the winning *Alliance* represented in the final *Match*.

9.5.12 Finalist Alliance Award
This award will be given to the finalist *Alliance* represented in the final *Match*.

10.0 Dean's List Award

In an effort to recognize the leadership and dedication of the most outstanding secondary school *Students* from *FIRST*®, the Kamen family sponsors awards for selected 10th or 11th grade* *Students* known as the *FIRST*® Robotics Competition and the *FIRST*® Tech Challenge *FIRST* Dean's List Award.

Similar to the very prestigious National Merit Scholarship Award, there are three (3) levels of *FIRST* Dean's List Award *Students*.

1. ***FIRST* Dean's List Semi-finalists** – comprised of the two (2) *Students* in their 10th or 11th school year* nominated by each *Team*.
2. ***FIRST* Dean's List Finalists** - The *Students* selected for each Regional Championship.
3. ***FIRST* Dean's List Winners** - comprised of the ten (10) *FIRST* Robotics Competition and ten (10) *FIRST* Tech Challenge *Students* selected from the applicable *FIRST* Dean's List Finalists.

The *Student*s who earn *FIRST* Dean's List status as a Semi-finalist, Finalist or Winner, are great examples of current *Student* leaders who have led their *Teams* and communities to increased awareness for *FIRST* and its mission while achieving personal technical expertise and accomplishment. It is the goal of *FIRST* that all Dean's List Semi-finalists, Finalists and Winners will continue, after high school, to stay engaged with *FIRST* as alumni. Additionally, in 2019, the Woodie Flowers Memorial Grant was established for Dean's List Award Winners pursuing STEAM fields of study.

For more information on the Dean's List Award, and to see past *FIRST* Tech Challenge winners, please visit our website! http://www.firstinspires.org/Robotics/ftc/deans-list

10.1 Eligibility
Every registered *FIRST* Tech Challenge *Team* can submit up to two (2) *Students* as *FIRST* Dean's List Award Semi-Finalists.

- *Students* must be a sophomore (grade 10) or junior (grade 11) to be eligible for this award.
    - Note: For regions of the world that do not use grade levels such as this to identify years of schooling: This award is intended for *Students* who are two (2) to three (3) years away from entering college or university. *Students* that would be attending college or university in the next academic year are not eligible. Mentors will be asked for the year of graduation during the nomination process.

- The coach or mentor nominating the *Student*(s) must submit an essay explaining why the *Student* should receive this award. The essay must be 4,000 characters or less.

10.2 Criteria
Criteria will be released 9-9-2023.

10.3 Dean's List Nominations
There are specific instructions on how to submit Dean's List Nominations. There are two sets of instructions, The Dean's List Nomination Guide – US, and the Dean's List Nomination Guide – International. Please visit our website for a copy of the guides, which provides in depth information about the Dean's List, and step by step visual aids to complete the nominations.

Appendix A – Resources

Game Forum Q&A

https://ftc-qa.firstinspires.org/

Anyone may view questions and answers within the *FIRST*® Tech Challenge game Q&A forum without a password. To submit a new question, you must have a unique Q&A system user name and password for your team.

Volunteer Forum

Volunteers can request access to role specific volunteer forums by emailing FTCTrainingSupport@firstinspires.org. You will receive access to the forum thread specific to your role.

FIRST Tech Challenge Game Manuals

Part 1 and 2 - https://www.firstinspires.org/resource-library/ftc/game-and-season-info

FIRST Headquarters Pre-Event Support

Phone: 603-666-3906
Mon – Fri
8:30am – 5:00pm
Email: Firsttechchallenge@firstinspires.org

FIRST Websites

FIRST homepage – www.firstinspires.org

FIRST Tech Challenge Page – For everything *FIRST* Tech Challenge.

FIRST Tech Challenge Volunteer Resources – To access public volunteer manuals.

FIRST Tech Challenge Event Schedule – Find *FIRST* Tech Challenge events in your area.

FIRST Tech Challenge Social Media

FIRST Tech Challenge Twitter Feed - If you are on Twitter, follow the *FIRST* Tech Challenge Twitter feed for news updates.

FIRST Tech Challenge Facebook page - If you are on Facebook, follow the *FIRST* Tech Challenge page for news updates.

FIRST Tech Challenge YouTube Channel – Contains training videos, game animations, news clips, and more.

FIRST Tech Challenge Blog – Weekly articles for the *FIRST* Tech Challenge community, including outstanding volunteer recognition!

FIRST Tech Challenge Team Email Blasts – contain the most recent *FIRST* Tech Challenge news for teams.

Feedback

We strive to create support materials that are the best they can be. If you have feedback about this manual, please email firsttechchallenge@firstinspires.org. Thank you!

Appendix B – Robot Inspection Checklist

Team Number: _____ Robot Inspection Status (circle): **READY / NOT READY**

Team	Insp.	Robot Size Inspection	Rule #
		Robot is presented at inspection with all mechanisms (including all components of each mechanism), configurations, and decorations that will be used on the Robot.	<I06>
		Separately test the Robot in all of its unique starting (pre-match setup) configurations. The Robot fits within the Sizing Tool without exerting undue force on the Sizing Tool sides and top.	<I06>a <RG02>
✓	✓	**General Robot Rules**	**Rule #**
		Robot does not contain any components that could damage the Playing Field or other Robots.	<RG01>a&b
		Robot does not contain materials that are hazardous.	<RG01>c
		Robot poses no obvious unnecessary risk of entanglement.	<RG01>d
		Robot does not contain sharp edges or corners.	<RG01>e
		Robot does not contain animal-based, liquid, or gel materials.	<RG01>f&g
		Robot does not contain materials that would cause a delay of game if released.	<RG01>h
		Robot does not contain elements that electrically ground the Robot frame to the Playing Field.	<RG01>i
		Robot does not contain closed gas, hydraulic, or vacuum based devices.	<RG01>j,k&l
		Team number is visible from at least 2 opposite sides and meets requirements.	<RG03>
		Alliance Markers are present and meet requirements.	<RG04>
		Energy used by the Robot shall come only from approved sources.	<RG05>
		Robot is not capable of detaching its own components.	<RG06>
✓	✓	**Robot Mechanical Parts and Materials Rules**	**Rule #**
		All components on the Robot are from allowable raw materials and Commercial Off The Shelf products.	<RM01> <RM02> <RM06>
✓	✓	**Robot Electrical Parts and Materials Rules**	**Rule #**
		Exactly one Main Power Switch is installed properly, labeled, readily accessible, and visible. The TETRIX, REV, MATRIX, and AndyMark switches are the only allowed Main Power Switch.	<RE01>
		All batteries are securely attached to the Robot in a location where they will not make direct contact with other Robots or the Playing Field.	<RE02>
		Exactly one (1) Robot Main Battery Pack of an approved type is on the Robot and it is properly connected to the Main Power Switch and either the REV Expansion Hub or REV Control Hub.	<RE03> <RE05>a, b(i&ii)
		Where present, fuses must not be replaced with fuses of higher rating than originally installed or according to manufacturer's specifications. Fuses are single use only.	<RE04>
		Allowed electronic devices are powered by power ports on the REV Expansion Hub or REV Control Hub except as noted in <RE05> and <RE14>.	<RE05>c
		The REV Expansion Hub and/or REV Control Hub is powered by the Robot main battery.	<RE05>b(i&ii)
		REV SPARKmini Motor Controllers and REV Servo Power Modules are powered by the Robot main battery or a REV Control or Expansion Hub XT30 port.	<RE05>a(iii&iv)
		Allowed sensors only receive power from the REV Expansion Hub or REV Control Hub.	<RE05>c
		Light sources (including LEDs) are not focused or directed in any way. Light sources are powered by allowed methods.	<RE12>a <RE12e>
		Video recording devices, if used, are powered by an internal battery and their wireless communication capability is turned off.	<RE05>d <RE13>a
		The smartphone Robot Controller Android device (if used) is powered by its internal battery or by the built-in charging feature of the REV Expansion Hub.	<RE05>f

		Exactly one Robot Controller (a) smartphone Android Device + REV Expansion Hub or b) REV Control Hub) is required. One additional REV Expansion Hub is allowed.	<RE06> <RE07>
		The only allowed Motor and Servo Controllers are: REV Expansion Hub, REV Control Hub, REV Servo Power Module, REV SPARKmini Motor Controller, and VEX Motor Controller 29.	<RE08>
		Robot contains no more than eight (8) DC motors of the allowed models.	<RE09>
		Robot contains no more than twelve (12) servos. They must be compatible with the attached REV Expansion Hub, REV Control Hub, REV Servo Power Module, or VEX Motor Controller 29 and not exceed the manufacturer specifications for the controller.	<RE10>
		Robot contains only allowed sensors and they are connected only to the REV Expansion Hub or the REV Control Hub.	<RE11>
		Power and motor control wires have consistent color coding with different colors used for the positive (red, white, brown, or black with a stripe) and Negative/Common (black or blue) wires.	<RE14>f
		Power, motor control, servo and sensor wires are the correct size.	<RE14>i
		If electronics are grounded to the *Robot* frame, the only approved method is the REV Robotics Resistive Grounding Strap. If needed, the REV Robotics Anderson Powerpole to XT30 adapter may connect to the Resistive Grounding Strap. No other grounding straps or cables are allowed.	<RE14>k
		Approved electrical and electronic devices may be modified to make them more usable; they may not be modified internally or in any way that affects their safety.	<RE15>
✓	✓	**Wheel/Tread Playing Field Damage Test - Optional**	**Rule #**
		Robot did not damage the Playing Field tile. [This is an optional test that is performed only when an Inspector believes that the drivetrain tread may damage a Playing Field tile.]	<I07>
✓	✓	**Team Game Element Inspection**	**Rule #**
		Inspection details will be released 9-9-2023	
✓	✓	**“Secret Team Scoring Element” Inspection**	**Rule #**
		Inspection details will be released 9-9-2023	

General Comment(s) or Reason(s) for Failure (if any):

Robot Inspector

Appendix C – Field Inspection Checklist

Appendix C – Field Inspection Checklist

Team Number: _____ Field Inspection Status (circle): **READY / NOT READY**

✔		Drive Team Members Present	Rule #
		Coach (required), Driver 1 (required); Driver 2 (optional), Human Player (optional)	<C06>
✔		**Driver Station and Robot Controller Hardware Rules**	**Rule #**
		Driver Station consists of only of one Android device (Circle): Motorola Moto G4 Play, Motorola Moto G5, Motorola G5 Plus, Motorola Moto E4, Motorola Moto E5, Motorola Moto E5 Play, or REV Driver Hub.	<RE07> <DS01>
		Smartphone Robot Controller Android device (if used) is one of the following models (Circle): Motorola Moto G4 Play, Motorola Moto G5, Motorola G5 Plus, Motorola Moto E4, Motorola Moto E5, Motorola Moto E5 Play. The Android device's USB interface only connects to a REV Expansion Hub or a USB hub.	<RE07>
		The touch display screen of the Driver Station is accessible and visible to field personnel.	<DS02>
		The Driver Station consists of no more than two of the allowed gamepads (Logitech F310, Xbox 360, wired Sony DualShock 4 for PS4, Etpark Wired Controller for PS4, Sony DualSense Wireless Controller for PS5), or Quadstick game controller in any combination.	<DS03>
		No more than one (1) optional external battery powered or unpowered USB hub is present.	<DS04>
		No more than one (1) optional COTS USB external battery connected to the REV Driver Hub USB-C port or a USB hub connected to the smartphone Android Device is present.	<DS05>
		Driver Station smartphone Android device (if used) USB interface is only connected to either a Mini USB to OTG cable or combination of cables connected to one USB Hub, or one gamepad USB cable connected to an OTG Micro Adapter.	<DS06>
		Driver Station Carrier (if present) meets requirements.	<DS07>
		The Driver Station Android Device only plays allowed sounds.	<DS08>
DS	**RC**	**Driver Station (DS) and Robot Controller (RC) Software Rules**	**Rule #**
		Android smartphone(s), REV Driver Hub, and REV Control Hub are named with the official team number followed by –DS or –RC as appropriate.	<RS01>
		Android operating system satisfies the requirements – version 7.0 or higher.	<RS03>
		DS and RC apps are version 9.0 or higher and the DS and RC apps have the same version numbers. The RC app is not installed on the DS and the DS app is not installed on the RC.	<RS03> <RS05> <RS06>
	NA	REV Driver Hub (if used) operating system is version 1.2.0 or higher.	<RS03>
	NA	REV Driver Hub (if used) has Bluetooth turned off and Wi-Fi turned on.	<RS07>
NA		REV Control Hub (if used) operating system is version 1.1.2 or higher and the firmware version is 1.8.2 or higher.	<RS03>
NA		REV Expansion Hub (if used) firmware version is 1.8.2 or higher.	<RS03>
NA		REV Control Hub (if used) has Wi-Fi turned on, Bluetooth is turned off, and the password is different than the factory default value of "password".	<RS07>
		Android smartphones (if used) are set to airplane mode, Wi-Fi is turned on, and Bluetooth is turned off.	<RS07>
		Android devices are not connected to any local networks.	<RS09>

		All remembered Wi-Fi Direct Groups and Wi-Fi connections on Android devices have been removed.	
		Communication between the Robot and Driver Station is only through the RC and DS applications. Out of band communication is not allowed.	<RS09>
	NA	Driver Station uses the official FTC Driver Station app to control the Robot.	<RS06>
NA		The FTC Robot Controller app on the smartphone Android Device (if used) is the default application, the application launches, and no other messages pop up.	<RS05>
NA		Robot Controller is set to the correct Wi-Fi channel (if required by the competition).	<C14>
✔		**Robot Operation Verified at the Playing Field**	**Rule #**
		Robot Controller connects with the Driver Station.	
		Robot switches between autonomous and driver-controlled operation correctly.	<RS04>
		Robot starts and stops when commanded by the Driver Station.	
		The team understands how to disable their Robot, if instructed to do so by a referee.	
✔		**Queuing Process Information Provided at the Playing Field**	**Rule #**
		Team understands that software changes are not allowed in the Queue Area.	
		Team understands that the match schedule is only an estimate. Matches may start prior to or after the scheduled time. It is the team's responsibility to monitor schedule changes and show up when required.	
		Team knows that they are responsible for attaching their Team Supplied Alliance Marker on two sides of their Robot before they approach the competition playing field.	<RG04>

General Comments or Reason(s) for Failure (if any):

_____

Field Inspector

Appendix D – Control Award sponsored by Arm Instructions

To be considered for the Control Award, *Teams* must submit a Control Award Submission Form. On this form, *Teams* identify and summarize the key control elements that make their *Robot* unique. Included is a description of key observable actions for judges to look for as well as the sensor and algorithm use that make it all possible. Judges will use this form for both evaluating control designs and when observing *Robots* on the *Competition* field. *Teams* should identify the control aspects of their *Robot* that they are most proud of. The Control Award Submission form may not exceed 2 pages.

Autonomous Objectives
List the overall actions that the *Robot* can complete. These should include scoring actions as well as other positioning and defensive operations. The *Robot* does not have to do accomplish all these in every program but should be demonstrable in at least one *Autonomous* program.

Sensors Used
List the sensors used to control the *Robot* and a brief description of how they are used.

Key Algorithms
List the key algorithms that make your *Robot* unique or are vital to its success on the field. Particularly complex or unique algorithms or those that integrate the use of multiple sensors are good candidates to highlight here.

Driver Controlled Enhancements
List any advanced control elements that are used during the *Driver-Controlled* period to enhance performance. These may include signaling operations when a certain condition is detected on the field, auto-complete functions, fail-safe algorithms, or just any enhancements that make the control of the *Robot* easier or more efficient for the driver.

Engineering Portfolio References
Judges also use the *Teams Engineering Portfolio* to evaluate details of the control elements. To help guide this effort, *Teams* should provide pointers to where in the *Engineering Portfolio* control related information is located.

Some things to consider including as pointers are: *Team* goals for control activities, strategies for *Autonomous* mode, *Robot* performance with and without added sensors, requirements for successful *Autonomous* operation, performance improvements using algorithms and sensors, and testing results.

Autonomous Program Diagrams
For *Autonomous* operations, *Teams* should draw and label a typical path the *Robot* takes. The labeled points identify key observable actions the *Robot* makes. For each labeled point, a brief description of what is taking place should be noted (see example below). Especially describe those key operations where adjustments are made to ensure accurate and repeatable performance.

For *Teams* with multiple *Autonomous* programs, it is not necessary to document every program on a separate sheet. It is sufficient document the most commonly used or complex programs and note variances for the rest.

Additional Summary Information (optional)
For those *Teams* that have developed many different control features, they may want to provide additional information to assist the judges in understanding their work. This is a place where *Teams* can provide more detailed information about their designs. It should be organized such that separate topics are easily identified and can be quickly found.

Appendix E – Control Award Sponsored by Arm Submission Form

Form will be released 9-9-2023

Appendix F – Award Definitions

All *Teams* are required to adhere to the following definitions in their award submissions and in their judge interviews.

***Team* Support Definitions**

Started (a *FIRST* LEGO League / *FIRST* Tech Challenge / *FIRST* Robotics Competition team) **-** "A *Team* has ***Started*** a *Team* if they have met one of the following requirements:

1. Funded or sourced funding (for example, grants or sponsorship) of at least 50% of the *Team* registration fee.
2. Made the *Team* aware of *FIRST* and/or the specific program and helped the *Team* with the official registration process.

As well as:

1. The ***Started*** *Team* agrees that the ***Starting*** *Team* did in fact ***Start*** them.
2. The ***Started*** *Team* competes in an official *FIRST* event.

The intent of this definition is to make it clear when a *Team* is responsible for bringing a new group into a specific *FIRST* program. Keys here are helping with funding OR introducing the new group to *FIRST* and helping them get registered as a *Team* in their specific program.

Cases where one *Team* has **Started** another *Team* will be rare. Cases where one *Team* has **Mentored** or **Assisted** a *Team* through their initial phases are very valuable, however they are distinct from **Starting** a *Team.*

Teams are encouraged to provide documentation (for example, a letter from the *Team* that has been **Started**) supporting the fact that they did indeed **Start** each *Team* referred to in the submission. New *Teams* can only be **Started** by two *Teams* and can only provide two of these letters. All provided documentation may be made available for judges during the second interview as an additional resource item.

Mentored (a *FIRST* LEGO League / *FIRST* Tech Challenge / *FIRST* Robotics Competition team) **-** "A *Team* has ***Mentored*** a *Team* if they have met all of the following requirements:

1. Providing consistent communication, either in person or via phone/email/video conference, to the ***Mentored*** *Team* helping with technical or non-technical *FIRST* program specific issues.
2. The ***Mentored*** *Team* agrees that the ***Mentoring*** *Team* did in fact ***Mentor*** them.

Mentoring a *Team* is a consistent and ongoing relationship. To be considered a ***Mentoring*** *Team*, you must be providing regular help to the ***Mentee*** *Team* during the season within their schedule. We understand that all *Teams* may not meet as regularly as once a week, however this is a general standard. For some *Teams* communication may be more infrequent and still considered consistent. We encourage *Teams* to use their best discretion when evaluating these edge cases. Helping *Teams* on a less consistent basis is still immensely valuable and important, however it would simply be considered ***Assisting*** a *Team*.

Teams are encouraged to provide documentation (for example, a letter from the *Team* that has been ***Mentored***) supporting the fact that they did indeed ***Mentor*** each *Team* referred to in the submission. All provided documentation may be made available for judges during the second interview as an additional resource item.

Examples (but not limited to) of consistent communication for ***Mentoring*** a *Team* include:

- *Team* A regularly sends *Students* to a nearby school to help their *FIRST* LEGO League team(s) with their *Robot* design and project presentations.
- *Team* A sends an email to *Team* B asking for advice on future *Robot* design. The two *Teams* email back and forth over a period of time exchanging questions and answers.
- *Team* A meets *Team* B at a competition. *Team* B expresses concern that their *Team* is struggling to keep the *Team* going and is looking for help. The two *Teams* live far away from each other, but over the next year, they exchange many emails, they video chat a few times during the off-season and even meet in person.

Examples (but not limited to) of Not ***Mentoring*** a *Team*:

- Answering a single email question.
- Inviting a *Team* to your shop so they may make parts on your machinery.
- Hosting a *Team* in your build space during inclement weather when they are unable to access their own facilities.
- Giving a *Robot* part to another *Team*.
- Allowing a *Team* to practice at your practice facility.

Assisted (a *FIRST* LEGO League / *FIRST* Tech Challenge / *FIRST* Robotics Competition *Team*) **-** "A *Team* has ***Assisted*** a *Team* if they have met all of the following requirements:

1. Providing communication, either in person or via phone/email/video conference, to the ***Assisted*** *Team* helping with technical or non-technical program specific issues. OR Providing funding and/or supplies to the ***Assisted*** *Team*.
2. The ***Assisted*** *Team* agrees that the ***Assisting*** *Team* did in fact ***Assist*** them.

Assisting a *Team* is a form of **Mentorship**, however it does not require the long term or consistent communication that is a defining characteristic of **Mentorship**. It is expected that all *FIRST* Tech Challenge *Teams* are constantly assisting their fellow *FIRST Teams*, and it is not necessary to try and document or count all the instances of **Assisting** that your *Team* has participated in.

Examples (but not limited to) of **Assisting** a *Team*:

- Answering a single email question.
- Inviting a *Team* to your shop so they may make parts on your machinery.
- Hosting a *Team* in your build space during inclement weather when they are unable to access their own facilities.
- Giving a *Robot* part to another *Team*.
- Allowing a *Team* to practice at your practice facility

Provided Published Resources to (a *FIRST* LEGO League / *FIRST* Tech Challenge / *FIRST* Robotics Competition *Team*) – A *Team* has ***Provided Published Resources*** to a *Team* if they have met all the following requirements:

1. The *Team* has created resources designed to aid *Teams* with technical or non-technical *FIRST* program specific issues.
2. The resources have been published or presented publicly (for example, presented at a conference, published on a *Team* website, etc.)

Many *FIRST* Tech Challenge *Teams* have created a wealth of resources that benefit numerous *Teams*. This kind of assistance is enormously valuable to our community and is heavily encouraged. However, these acts do not meet the definition of ***Mentoring*** since they lack consistent communication involved in mentoring**.** To recognize and encourage these important efforts, the definition of ***Provided Published Resources*** was created.

Teams are encouraged to provide documentation (for example, letters from *Teams* who have used the resources; screenshots of downloads/engagement/digital impression statistics; attendance numbers) supporting the overall reach of their ***Published Resources*****.**

If ***Published*** online, *Teams* should provide a link to the resource. Links to *Team* websites, sharing sites (e.g., YouTube), or collaborative sites between *FIRST Teams* are all appropriate. All provided documentation may be made available for judges during the second interview as an additional resource item.

Examples (but not limited to) of ***Providing Published Resources***

- *Team* A creates and publishes a scouting database compiling statistical data from competitions, and the database is downloaded and used by other *Teams.*
- *Team* A creates and gives a presentation on *FIRST* fundraising to an audience of 15 local *FIRST* Tech Challenge and *FIRST* LEGO League *Teams*.
- *Team* A develops and publishes a mobile app that contains *FIRST* LEGO League tutorials, and the app is downloaded and used by *FIRST* LEGO League *Teams.*
- *Team* A creates and publishes *FIRST* Tech Challenge drivetrain video tutorials on YouTube, and videos are watched and used by *FIRST* Tech Challenge *Teams*.

Event Support Definitions:

Ran (a *FIRST* LEGO League / *FIRST* Tech Challenge / *FIRST* Robotics Competition *Team*) - A *Team* has ***Run*** an event if they have met all the following requirements:

1. *Team* members are involved in the majority of the planning of the event.
2. *Team* members are involved in the majority of the on-site event execution or have arranged for and are supervising the volunteers to handle the majority of the on-site event execution.

Running an event essentially means that this event would not be possible without the efforts and actions of the given *Team*. The *Team* in question must be responsible for the majority of the work that goes into the event.

Team are encouraged to provide documentation (for example, a letter from organizing body/program delivery partner that the event was ***Run*** for) supporting the fact that they did indeed ***Run*** the event. All provided documentation may be made available for judges during the second interview as an additional resource item.

Examples (but not limited to) of ***Running*** an event:

- *Team* A acts as the majority of the planning committee for a *FIRST* LEGO League event, and *Team* members recruit and train the event volunteers.

Hosted (a *FIRST* LEGO League / *FIRST* Tech Challenge / *FIRST* Robotics Competition *Team*) - A *Team* has ***Hosted*** an event if they have met one of the following requirements:

1. The event takes place at a *Team* facility.
2. The event takes place at a facility arranged for by the *Team.*

Hosting an event occurs when a *Team* opens one of their own facilities or arranges for a facility to allow for an event to occur. Often *Teams* will **Run** and **Host** the same event, but these terms do not necessarily have to be linked.

Supported (*FIRST* LEGO League / *FIRST* Tech Challenge / *FIRST* Robotics Competition *Team*) - A *Team* has ***Supported*** an event if they have met any of the following requirements:

1. Multiple *Team* members are involved in some part of the planning of the event.
2. Multiple *Team* members are involved in the on-site or online event execution for the entirety of the event (for example, *Team* members have volunteered for the entirety event)

Teams ***Support*** events by helping with the planning or execution of the event. This is less encompassing than ***Running*** an event.

Examples (but not limited to) of ***Supporting*** an event:

- Having multiple *Team* members volunteer at the entirety of an event.
- Having a few mentors serve on a large planning committee for a *FIRST* Tech Challenge regional event.

Examples (but not limited to) that do **not** qualify as ***Supporting*** an event:

- Having 1 *Team* member volunteer at an event.
- Helping tear down the field at the end of an event.
- Having 1 mentor serve on a large planning committee for a *FIRST* Tech Challenge regional event.

Reached - A *Team* has ***Reached*** someone if someone has interacted or observed the *Team* in some capacity whether it be digitally or in person, regarding the ***Reaching*** *Team's* program(s).

Reach is the all-encompassing number of people who became aware of your *Team* via a stated medium/event. ***Reach*** requires tangible interaction or observation of the *Team*, not merely seeing the *Team* in the background of a show or public exhibit.

Examples (but not limited to) of ***Reaching*****:**

- 6,000,000 people watch a TV show that features a *Team's Robots*. This *Team* has ***Reached*** 6,000,000 people.
- 1,000,000 people attend an event where the *Team* has an exhibit. However, only 500 of those people see the *Team's* actual exhibit. This *Team* has ***Reached*** 500 people.
- 30,000 people attend a football game, where the *Team* performs with their *Robots* during the halftime show. This *Team* has ***Reached*** 30,000 people.
- 700 people follow a *Team* on Instagram. This *Team* ***Reached*** people 700 people.

Examples (but not limited to) of **not** ***Reaching*****:**

- 6,000,000 people watch a TV show in which the *Team's Robots* are used as background props. Since the *Robots* nor the *Team* have been featured, this *Team* has not ***Reached*** the audience.
- 30,000 people attend a football game, where the *Team's* name is shown on the big screen at the stadium. This is not a tangible interaction or observation of the *Team*; thus, this *Team* has not ***Reached*** the audience.

The goal with using ***Reach*** in submissions is to accurately convey the number of people who have become aware of your *Team*. However, it is difficult to provide exact numbers when it comes to the numerous public demos *Teams* participate in every year. It is important that *Teams* do not embellish or exaggerate these numbers, as doing so would paint a misleading picture of the *Team's* accomplishments. When in doubt, *Teams* should try and estimate on the low end.

Teams are encouraged to provide documentation that shows the basis of their estimates of ***Reach***. (for example, letters from event organizers stating event attendance and specific area attendance). Documented evidence and breakdowns of ***Reach*** numbers are far more compelling than simply stating the *Team's* estimated ***Reach***. All provided documentation may be made available for judges during the second interview as an additional resource item.

Advocated - A *Team* has engaged in ***Advocacy*** if they meet any of the following criteria

1. Met with government officials, community leaders, school administration, or business leaders (or their staff) to discuss and engage with and promote public policy changes towards the promotion of STEM/*FIRST*.
2. Developed relationships with government officials, community leaders, school administration, or business leaders (or their staff) to promote public policy changes towards the promotion of STEM/*FIRST*.
3. Served as a resource for government officials, community leaders, school administration, or business leaders (or their staff) as they create public policy changes towards the promotion of STEM/*FIRST*.

Examples (but not limited to) of engaging in ***Advocacy*** are:

- Attending an advocacy day where *Teams* from the area met with local officials on afterschool STEM engagement programs
- Working with leaders to craft a bill or resolution that was introduced

Examples (but not limited to) of not engaging in ***Advocacy*** are:

- Using social media/tweeting to government officials
- Volunteering for a campaign
- Hosting a table/tabling/handing out flyers at parade or event (people must engage not just a passive act)
- Soliciting and recruiting sponsors solely for your *Team* (for example, fundraising)

Teams are encouraged to be specific about when they started an initiative or participated in one. All provided documentation may be made available for judges during the second interview as an additional resource item