FIRST TECH CHALLENGE

CENTER STAGE
PRESENTED BY Raytheon Technologies

FIRST® IN SHOW℠
presented by Qualcomm

firstinspires.org/robotics/ftc

2023-2024 *FIRST*® Tech Challenge

FIRST Technical Advisor

Sponsor Thank You

Thank you to our generous sponsor for your continued support of the *FIRST*® Tech Challenge!

Volunteer Thank You

Thank you for taking the time to volunteer for a *FIRST*® Tech Challenge event. *FIRST*® and *FIRST*® Tech Challenge rely heavily on volunteers to ensure events run smoothly and are a fun experience for teams and their families, which could not happen without people like you. With over 6,500 teams competing yearly, your dedication and commitment are essential to the success of each event and the *FIRST* Tech Challenge program. Thank you for your time and effort in supporting the mission of *FIRST*!

Contents

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.

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.

Learn more about the roles of volunteers on our Volunteer Resources page, "Volunteer Role Descriptions".

FIRST Privacy Policy

FIRST takes the privacy of our community seriously. As a nonprofit and a mission-driven youth-serving organization, we are compelled to understand who we are serving, how our programs are performing, and make improvements so that we can achieve our goals of making *FIRST* accessible to any youth who wants to be part of the fun, exciting and life-changing experience. Thus, we need to collect certain personal data from participants and volunteers to ensure we are meeting our goals and responsibilities as a youth-serving nonprofit organization.

As a volunteer, you may be asked to handle the personal data, or personally identifiable information (PII), of coaches, team members, and even other volunteers. It is critical that you understand and follow the *FIRST* Privacy Policy and complete any data protection and privacy training required by your role. If you have any questions regarding data protection and privacy, please reach out to the *FIRST* Data Governance Team at privacy@firstinspires.org.

Volunteer General Information

Volunteer Training and Certification

To Access BlueVolt and Complete a Volunteer Role Training Course:

Once you have applied for a volunteer role that requires certification a link will appear in your *FIRST* dashboard that will connect you to our learning management system BlueVolt.

1. Login to your *FIRST* Dashboard
2. On the grey menu below "Dashboard" Click on "Volunteer Registration"

3. Click on “Roles Missing Certification”
    a. Click into the link to “Review Outstanding Tasks” which will take you to the BlueVolt site where you can complete your certifications and sign up for new training.

How to Access BlueVolt After Certifications are Complete:

Once you complete your certifications, you will no longer see a “Roles Missing Certification” link or a link to “Review Outstanding Tasks” to get to BlueVolt. If that is the case, follow the steps below to access BlueVolt courses and updates.

1. Login to your *FIRST* Dashboard.
2. At the top right of the page, click on the dropdown under your name and go to “My Profile”.
3. Once there, on the left menu of the page, click on the “Certifications” link which will take you to the BlueVolt site where you can view/print your existing certifications and sign up for new training.

If you have applied for a role but do not see the link to training in your dashboard, or you have other training related questions please email FTCTrainingSupport@firstinspires.org.

Volunteer Minimum Age Requirement

The minimum age requirement of a *FIRST* volunteer is **13 years old**.

A minor must have a parent or guardian give written permission to volunteer. In addition, the *FIRST* Consent and Release Forms will need to be signed by a parent or guardian in the Volunteer Registration system for any volunteer under age 18.

Key Volunteer Role Minimum Age Requirement

Volunteers MUST be at least 21 years old before they can serve in a key volunteer role for the *FIRST* Tech Challenge. Key volunteer positions include volunteer coordinator, head referee, judge advisor, field supervisor, *FIRST* technical advisor, lead robot inspector, lead field inspector, and lead scorekeeper. Local program delivery partners can make case by case exceptions to these guidelines by contacting *FIRST* for approval.

Bring a Friend!

Volunteers are a huge part of the *FIRST* Tech Challenge Program and continue to inspire students to seek out careers in science, technology, engineering, and math (STEM). *FIRST* Tech Challenge needs your help in recruiting new volunteers to keep our programs thriving for future generations! If you have a friend or co-worker you think would be interested in volunteering at an event, there are just a few easy steps to help get them involved!

1. Check out our full list of volunteer opportunities online!
2. Have them apply for the Event in the Volunteer Registration System. Volunteers must be screened before volunteering.
3. Have them contact FTCTeams@firstinspires.org with any questions they may have.

If they are concerned about jumping in headfirst, no worries! Job shadowing at a *FIRST* Tech Challenge Event is a great way to get a taste of what a full day’s worth of competition looks like. New volunteers can discover ways they can fit their personal skills into a volunteer position!

Helping Teams Succeed

A volunteers role is about helping a team succeed so they can compete. Teams spend countless hours, weeks and sometimes months working and reworking their robot design and strategies. After all this effort, some teams will still need a friendly volunteer to help create a positive event experience for the students.

Job Description

Introduction

The *FIRST* technical advisor (FTA) is the lead technical volunteer, an advocate for teams, and an advisor to the head referee. The FTA role is a key volunteer position that requires great people skills. An FTA's time is primarily spent providing technical support to students setting up their robots for a match. Additional duties include managing technical volunteers, setting up and tearing down the robot playing fields, overseeing inspection, performing playing field maintenance, and providing technical support for the FTC Live scoring system.

Event Time Commitment

Most *FIRST* Tech Challenge events are whole-day events. In addition, plan on one to three hours for set-up and tear down of the field.

Prerequisites for the FTA Role

A well-rounded FTA needs to have the following knowledge/skills:

- In-depth knowledge of the *FIRST* Tech Challenge Android-based control system;
- Experience with the TETRIX® and REV Robotics® Design Systems;
- Familiarity with the *FIRST* Tech Challenge Live Scoring System;
- Experience with devices running the Android operating system;
- Experience/familiarity with computers, especially those running the Windows® 7 or higher operating system;
- Experience with Wi-Fi and Wi-Fi Direct networking;
- Ability to use deductive reasoning to solve technical problems; and
- Ability to repair damage to the playing fields.

Physical/Technical Requirements

- Technical – High
- Physical – Medium (can be completed sitting or standing)
- Administrative – Medium • Communication – High • **Time commitment:**
    - Pre-Event Training – Approximately eight to ten hours ○ Event Day – Approximately six to ten hours

Proper Safety Attire:

- Wear comfortable, closed-toe and closed-back shoes that will not damage the competition playing field foam tile floor.
- ANSI Z87.1 certified safety glasses are required in both the competition area and the team pits.

Related Technical Roles

In addition to working with the field supervisor, the FTA will work with Control System Advisor (CSA) and the Wi-Fi Technical Advisor (WTA) volunteers. The FTA will assume the responsibilities of the CSA and/or WTA if these volunteer roles are not staffed. The CSA's responsibility is to provide complimentary, in-depth technical support to teams at an event. If an FTA is working with a team and encounters a technical issue that requires in-depth troubleshooting, then the FTA should direct the team to visit the CSA for more extensive technical support.

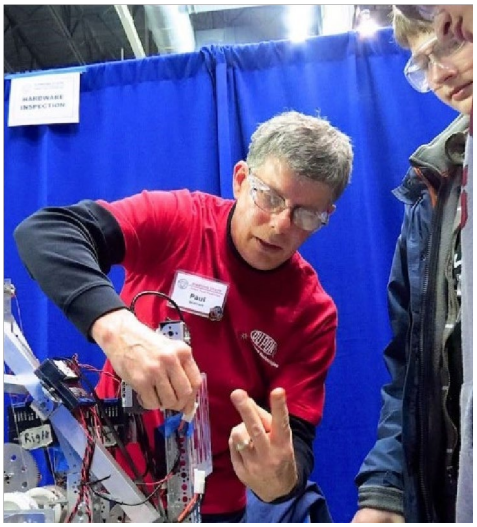
The WTA's responsibility is to conduct a pre-competition Wi-Fi site survey and monitor, police, and troubleshoot the wireless environment during an event. If a FTA suspects that there is interference or malicious activity on

the wireless spectrum that has the potential to disrupt an event, then the FTA should consult with the WTA to troubleshoot and resolve the issue.

FIRST Technical Advisor Safety

Dress for this role includes ANSI Z87.1 certified safety glasses or side shields on shatterproof prescription eyeglasses worn always on and around the competition playing fields and in the pit areas. In addition, wear comfortable clothing that will allow you to move easily and **closed-toed** and **closed-backed** shoes that will provide all-day-on-your-feet comfort and will not harm the foam playing field floor covering.

Pre-Event Day Responsibilities



FIRST Tech Challenge competitions squeeze a lot of activity into one day. One of the keys to running a smooth and successful event is for teams and volunteers to show up prepared. Teams spend countless hours preparing for competition day and we ask our volunteers to prepare for competition day as well. It is important that prior to the event, the FTA reviews the FTA Manual, watches the pre-recorded FTA training video, and reads the supporting documents listed in the checklist below. These training materials will help FTAs to pass the required *FIRST* FTA Certification test.

The training materials provide the technical knowledge needed to keep a competition running smoothly as well as FTA responsibilities at an event. Scheduled monthly key role discussion calls provide an opportunity to ask questions and share ideas and feedback with other FTAs. Learning ahead of time will go a long way towards keeping the event running smoothly and on time.

Mastering the *FIRST* Tech Challenge technology requires specialized study. The robot electronics and behaviors are unique to the *FIRST* Tech Challenge program and completing the pre-competition checklist below will help the FTA prepare for their highly visible volunteer role and help assure a fun and successful competition day. The document names that are underlined are hyperlinks to public documents on the *FIRST* Tech Challenge website. The remaining documents are stored in BlueVolt, a learning management system (LMS) and in the FTC Resource Library.

Outlined below are responsibilities an FTA has before event day. Make sure to check with the tournament director to see if they need help setting up before the event.

- Read this manual and complete all the checklists. Bring it to the competition for the technical element references it provides.
- Read the Control System Troubleshooting Guide, which explains how to troubleshoot common problems with the *FIRST* Tech Challenge Android-based control system. An electronic or printed copy of this guide will be helpful on competition day for the technical element references it provides.
- Read the Wi-Fi Technical Advisor Manual in the event you will also cover this important volunteer role.
- Read the *FIRST* Tech Challenge Wi-Fi Event Guide and Wireless Event Checklist.
- Read the Control System Advisor Manual in the event you will also cover this important volunteer role.
- Read the *FIRST* Tech Challenge Robot Wiring Guide.
- Watch the FTA Training video in BlueVolt.

- Watch the *FIRST* Tech Challenge REV Electronics Tutorials, and check out the REV Control System Docs REV Driver and Control Hub videos.
- Read the Scorekeeper Manual and Event Admin Scoring System Guide, which prepares the FTA to provide technical assistance to the scorekeeper. You may find it beneficial to attend the scorekeeper's training teleconference or listen to a recording of an earlier teleconference.
- Watch the *FIRST* Tech Challenge Game Animation/Video. Focus on understanding what the teams are trying to accomplish during a match and the names of the playing field elements.
- Download the Game Manual Part 1, paying special attention to *Section 4, Competition Day Outline* to become familiar with the competition terminology and structure. It would be beneficial to also read *Section 7* for the robot construction rules and the Game Manual Part 2 to learn the game rules.
- Read the Field Supervisor Manual if you will also be serving in that capacity; otherwise a general perusal of that manual will be helpful.
- Participate in the monthly FTA Discussion Calls or listen to their recordings. The call schedule will be available in the *FIRST* Technical Advisor folder in BlueVolt, which can be accessed after applying for the role of FTA.
- Pass the online FTA Certification test.

The FTA should perform the following tasks prior to every event:

- Read the Field Tech Advisor Discussion Forum located on the FTC Forum subforum https://ftccommunity.firstinspires.org This is a discussion forum where volunteers can ask questions or share tips and best practices with one another. *FIRST* staff will respond to posts and share tips and important technical information in this forum.
- Verify the technical volunteer staffing levels with the volunteer coordinator or tournament director. Each playing field should have one FTA and one FTA Assistant. An FTA Assistant Floater is recommended and can support up to two playing fields. All events should have at least one CSA to provide in-depth technical support to teams. Large events should have several CSAs. Very large events such as a championship tournament should have a WTA to oversee the wireless spectrum during the event.
- Verify with the volunteer coordinator that the lead robot inspector and the lead field inspector have the necessary materials and volunteer staffing for the event.
- A week prior to the event, check the Scorekeeper Github repo page to see if there are any updates to the Scoring System.
- The wireless technical advisor or control system advisor should conduct a wireless survey of the venue to make sure the wireless environment is clear and that there are no Wi-Fi suppressors operating in the venue. The FTA will perform this task if a WTA or CSA is not available. Coordinate this activity and share the results with the tournament director. Use one or more pairs of Android devices to measure the ping time in different areas of the venue and on different Wi-Fi channels of the spectrum.
- Select preliminary Wi-Fi channels for the robot Wi-Fi communications, the *FIRST* Tech Challenge Live Scoring System, and any other Wi-Fi Access Points needed to run the event based on the Wi-Fi site survey of the venue. Share the channel recommendations with the tournament director and the lead field inspector.

Event Day Responsibilities

Event Day Competition Set-Up

- Competition setup generally occurs on the day before the competition. Setting up the competition area and testing the wireless environment normally takes two to three hours for a single field event and three to four hours for a two-field event. The FTA will work with the field supervisor (FS) and volunteers to set up the competition playing field(s) and the practice field(s). It is helpful to have a robot and control system, or at least a pair of Android devices running the *FIRST* Tech Challenge apps (*FIRST* Tech Challenge Driver Station app and *FIRST* Tech Challenge Robot Controller app) to test the wireless environment on the field. Once the playing fields are set up, the FS will verify that the fields are set up as instructed by the Field Assembly Guide.
- Be sure to have all passwords of the computers or devices being used, if applicable.
- The Android-based robot control system does not require any centralized control infrastructure. Teams will bring their own driver stations and robot controllers to the event. However, if a WTA or CSA is not available, the FTA should do a wireless survey, conduct wireless tests, and select candidate Wi-Fi channel(s) for teams to use during match play. This helps to avoid troubleshooting wireless issues immediately before an event. Feel free to use the telephone number in Appendix A to contact the on call technical support person if there are any problems with the setup or the wireless spectrum on event day.
- Collaborate with the scorekeeper to set up the Audience and Field Displays.
- The scorekeeper is usually responsible for setting up and testing the scoring computer and, if used, the real-time scoring system devices for scoring refs, inspectors, and other users. The FTA should verify with the scorekeeper that the Scoring System is set up. The FTA should have a printed copy of the scoring tablet passwords.

Event Day for the FIRST Technical Advisor

- Arrive early; the FTA should be one of the first volunteers to arrive on event day.
- Verify that the reserved wireless channels for the competition playing fields are clear and that low ping times are observed for a test robot controller-driver station pair operating on these channels. The WTA or CSA will perform this task if the event staffs these volunteer roles.
- Verify that the lead robot inspector and lead field inspector are good to go before the scheduled start of inspection. Periodically visit these volunteers while inspections are underway.
- Meet with the CSAs, WTAs, and FTA Assistants to confirm their activity plans for the event.
- Assist with field inspection of the robots.
- Meet with the head referee prior to the opening ceremony to discuss the flow of match-to-match activities, the FTA's triage protocol for pre-match robot setup, in-match issues, and post-match discovery. Assure the head referee that you will provide timely assistance to teams and that you will make the difficult call to start a match with a non-functioning robot after the recommended triage and remediation steps in the Control System Troubleshooting Guide have been performed. Sharing the FTA's triage protocol with the head referee will help the competition day run smoother.
- Attend the opening ceremonies and be prepared to start the first match directly following the ceremony.
- The remainder of the day will be spent overseeing the technical volunteers around the competition playing field(s), assuring that the Wi-Fi channels are free from interference, and performing robot triage. The WTA and/or the CSA will assist with monitoring the Wi-Fi channels if these volunteer roles are staffed.

- Unexpected robot behavior will happen during the competition. It is the FTA's responsibility to determine if a robot issue or an external issue like wireless interference caused the unexpected behavior. More detail is provided in the Dealing with Team Issues/Concerns section of this manual.

Required Event Day Equipment & Document List for the FIRST Technical Advisor

- Safety glasses are required.
- Closed-toe and closed-back comfortable shoes (that will not damage the field) are required.
- Small battery-powered flashlight or headlamp.
- Multifunction Voltmeter/Ammeter/Ohmmeter with probes.
- A pair of *FIRST* Tech Challenge approved Android devices.
    - Current *FIRST* Tech Challenge driver station app installed on one device. ○ Current *FIRST* Tech Challenge robot controller app installed on the other device.
    - Wi-Fi Analyzer app (Available from the Google Play Store) installed on driver station device.
- USB FLASH drive with current *FIRST* Tech Challenge apps (driver station, robot controller).
- Hardcopy or electronic copy of the FTA Manual.
- Hardcopy or electronic copy of the Control System Troubleshooting Guide.
- Hardcopy or electronic copy of the Wi-Fi Event Checklist.

Schedule Mindset

A valued measure of event quality is starting and finishing on-time. Attendees plan their day based on the published schedule. Ending significantly late affects travel plans, may interfere with bus driver duty-time limits, disrupt teams' post-event meals and celebrations, etc.

Robotics competitions are complex to run, and there are many opportunities for schedule slowdowns, including robot malfunctions, post-match scoring and penalty discussions, tardy teams, etc. How does an FTA manage the occasional need to spend extra time helping teams overcome a technical challenge?

The FTA's mindset should be schedule aware, not schedule driven. Occasionally delaying a match to assure that all four robots participate is usually worth the impact on the schedule. The recommended goal for the competition area volunteers is to stay within +/- one match of the published match schedule. If the matches run +/- two matches, it is time to look for ways to speed up or slow down matches so the tournament returns to a rhythm of +/- one match. Using this as a guide, the FTA is empowered with the flexibility to take extra time to help a team and their robot prepare for a match.

FTA and Head Referee Match Workflow

FIRST Tech Challenge implemented the concept of playing field ownership by the FTA and head referee during the match workflow timeline. The key volunteer that owns the playing field is responsible for everything that occurs on the playing field. Specifying which key volunteer oversees the playing field and how field ownership transitions between these volunteers improves workflow efficiency. The recommended playing field ownership timeline is as follows:

1. The head referee owns the playing field starting when the FTA signals to the head referee that the drive teams and their robots are ready to start the match and ending when the referee crew signals to drive teams that they may remove their robots from the playing field. For example, the head referee owns the playing field during the following activities:
    a) Verifying robot physical setup on the playing field.
    b) Informing drive teams that they may no longer touch their driver stations until the match starts.
    c) Randomization of the playing field elements.
    d) Autonomous period.

e) Transition between the Autonomous and Driver-Controlled periods.
f) Driver-Controlled period.
g) Post-match score certification.
h) Signaling drive teams to remove their robots from the playing field.

2. The FTA owns the playing field at all other times. For example, the FTA owns the playing field during the following activities:
    a) Playing field reset.
    b) Robot setup on the playing field by the drive teams.

Prior to the start of qualification matches, the FTA should meet with the head referee to confirm how they will work together across the match workflow timeline. The head referee should be familiar with the field ownership concept because it is described in the Referee manual.

Pre-Match Responsibilities for the FIRST Technical Advisor

The FTA and the *FIRST* Technical Advisor Assistant (FTAA) are responsible for verifying that the drive teams and their robots are ready for the start of all matches. FTAs and FTAAs should feel free to stand on the playing field while drive teams are setting up their robots. This is the best location to assess status, provide immediate assistance, and project a clear visual indication that the FTA/FTAA has not released the playing field to the referee crew. As a team advocate, the FTA/FTAA should aid drive teams that are having technical difficulties and assure that a reasonable amount of time is devoted to performing the triage and remediation steps recommended in the Control System Troubleshooting Guide. Most control system set up problems can be resolved in two minutes or less. In extreme cases, a few extra minutes are required to power cycle the Android devices. If the recommended repair steps in the Control System Troubleshooting Guide and power cycling the Android devices do not solve the problem, the FTA will have to make the difficult decision to start the match with a non-functional robot.

Here's a step-by-step guide to the recommended pre-match FTA/FTAA activities:

1. Perform repairs and adjustments to the playing field, as needed. Rule <GS08> specifies that competition provided playing field and game elements will start each match with tolerances that may vary by +/-1.0 inch (25.4 mm). Playing field and game elements are expected to be manufactured, assembled, and set up using a high standard for dimensional and location accuracy. The intent of the generous +/- 1.0 inch tolerance is to accommodate unintentional size and location variations that may occur. The tolerance is not an excuse for intentional or imprecise accuracy in construction or setup.
2. After drive teams arrive at the playing field, the FTA and FTAA will:
    a. Focus on helping one alliance per FTA/FTAA and provide, as needed, support to the other alliance robots when appropriate.
    b. Welcome the drive teams to the playing field from a position on the playing field floor.
    c. Drive teams may perform the optional robot wiggle test on their own.
    d. Observe robot set up, gently redirect drive teams to the task at hand if they are distracted and help when necessary. If the drive teams are setting up without issue, use your free time to give the robot a quick inspection to help the team have a successful match:
    e. Look for entanglement issues or disconnected wires.
    f. Confirm that the REV Expansion Hub and REV Control Hub status LEDs have a blink pattern indicating that they are ready for the start of a match.
    g. When applicable to the game, confirm that the drive team has preloaded the allowed scoring element(s).

   h. Remind the drive teams to untangle their driver station cables, as appropriate.
3. Observe the following information on the driver station Android device after the drive team is finished setting up their robot.
   *For the early matches, explain the items you are checking to the drive team. In later matches, most drive teams will have learned to perform these checks themselves, enabling them to correct issues before an FTA/FTAA finds them.
   a. Confirm that the driver station is wirelessly connected to the robot controller.
   b. Confirm that the gamepads are registered in the driver station app.
   c. Check ping times.
   d. Verify that the robot main power is turned on.
   e. If the robot is participating in the autonomous period, verify that an OpMode is selected and the initialization routine is executed.
   f. Verify that the 30 second stop timer is engaged if the drive team is running an Autonomous Op Mode.
4. Signal to your FTA/FTAA partner when your alliance's robots are ready to start the match.
5. The FTA signals the Head Referee when the robots and drive teams are ready to start the match.

These FTA/FTAA pre-match setup activities help drive teams have a successful match and they can be performed within the desired match-to-match cycle times.

Robot Wiggle Test (Optional)
Teams may, at their discretion, perform a robot wiggle test during robot pre-match set up to verify that the drive team is able to control their robot. Identifying problems before the start of a match period allows the FTA/FTAA to perform triage on the robot before starting the period of play.

During pre-match setup, the robot wiggle test is performed by teams on the playing field by running a driver-controlled OpMode and using a gamepad to slightly move a servo (recommended) or DC motor. Controlled servo or DC motor motion confirms that the driver station is communicating with the robot controller Android device and the controller subsystem is operational. After a successful wiggle test, the drive team sets up their robot as usual for the autonomous period. The robot wiggle test is not a coordinated test with all the teams participating together; drive teams may perform the test as part of their normal set up procedure.

Robot Triage
Once there is an issue on the playing field, the FTA/FTAA's role is to find out the problem and figure out the cause. An FTA/FTAA is like an investigative reporter, finding the facts before concluding, and then acting on what is found out. The Control System Troubleshooting Guide describes unexpected robot behaviors and their telling characteristics for proper diagnosis. This should help you learn more about the common problems and how to solve them. When problems arise, the FTA/FTAA should gather information by using the following guidelines:

Before the start of Autonomous the *FIRST* Technical Advisor may:
- Talk with members of the affected drive team.
- Recommend corrective action to the drive team.
- With permission, touch the team's robot, gamepad controllers, etc.
- Check the status of the robot by visual inspection of the robot, the robot controller, and the driver station.

Transition from Autonomous to Driver-Controlled periods:
Unexpected robot behavior may occur during the Autonomous period. The behavior could be caused by team error, robot interaction with other robots or field elements, or by events that are not the responsibility of the

team. Problems caused by team error, or interaction with robots or field elements will not be repaired until the robot is released to the team after the conclusion of the match (i.e., end of the driver-controlled period.) Examples of problems caused by team error are:

- Loose power wires.
- Loose or disconnected cables.
- Broken chain or tread.
- Low or dead battery.

The FTA and team should not repair the problems listed above, any other team-created issue, or robot interaction issues during the transition between the autonomous and driver-controlled periods. Rule <G1> in the Game Manual Part 2 addresses the autonomous to driver-controlled period transition.

> <G1> Autonomous to Driver-Controlled Period Transition – At the conclusion of the Autonomous Period, Robots will remain in a hands-off state. Field personnel will not enter the field and will not touch Robots on the field during the Autonomous to Driver-Controlled transition. The scoring system display will provide visual and audio cues for Drive Teams to pick up their Driver Stations. Drive Teams will have five (5) seconds to pick up and prepare their Driver Station. After five (5) seconds, there will be a "3-2-1 go" countdown and the Driver-Controlled Period of the Match will begin.

During autonomous or driver-controlled periods the *FIRST* Technical Advisor and FTAA may:

- Talk with members of the affected drive team.
- Recommend corrective action to the drive team.
- With permission, touch the driver station.
- Check the status of the robot on the team's driver station display.
- Look at the robot while remaining outside the playing field walls.
- Turn off robot power if the robot has lost communication with its driver station and is at risk for burning out a motor or causing damage to the playing field or other robots. Perform this action only if it can be done safely.

During autonomous or driver-controlled periods the *FIRST* Technical Advisor and FTAA may NOT:

- Enter the playing field.
- Touch a robot, unless the robot is out of control of the driver station and is likely to cause damage to the playing field, people, other robots, or itself. This action should be performed only if it can be done safely.

Exceptions to entering the playing field occur during dangerous conditions on the playing field such as a robot on fire or a robot that has lost communication with the driver station and it is a danger to teams, volunteers, spectators, itself, other robots, or playing field elements, etc.

Robot triage is limited to what the FTA can see on the driver station display, observe about the robot, and see on the robot controller display or log files. Consult the Control System Troubleshooting Guide for details on how to use these tools to troubleshoot a problematic robot.

The FTA may need to investigate unexpected robot behavior at the end of a match while robots are on the playing field. Robots that lose the communication link with their respective driver station may continue to move after the conclusion of the match. When this occurs, turn off the robot's main power switch, as soon as possible, to avoid damaging robots or the playing field elements. When entering the playing field, be careful not to affect match scoring by moving robots and scoring elements.

Android Device Software Settings Viewer

The robot Field Inspection Self-Inspection code[1] is integrated into the driver station and robot controller apps. This feature displays the status of all the required Android device software settings on a single screen. This enables an FTA/FTAA to quickly check the status of the software settings that are important to the successful operation of a FIRST Tech Challenge robot.
The software inspection function is accessible from the dropdown menu in the driver station and robot controller apps. The driver station can remotely view the robot controller's software inspection status while the two Android devices are connected.

Disabled Robot

A robot that breaks down, is uncontrollable, damages the playing field, or is a safety hazard should be declared "disabled" and remain parked for the remainder of the match. This type of unexpected robot behavior is a clear signal that the FTA should visually investigate the robot's symptoms, help the drive team, and then report the findings to the head referee, as soon as possible. The head referee is responsible for the final determination to declare a robot disabled because of the impact on scoring and penalties.

Match Replays

The most important role of the FTA is correctly diagnosing the problem and working with the head referee to determine if the issue will cause the match to be replayed. Matches should be replayed if the issue or malfunction can be **absolutely traced back to excessive wireless interference**. Issues caused by the team's robot do not warrant a match replay.

Since the match replay is oftentimes what the teams are most concerned about, the FTA needs to be on hand to explain the situation to the teams, including why the problem happened and how they can fix it for the next match.

Rule **<G9>** in the Game Manual Part 2 addresses match replays:

<G9> Match Replay – *Matches* are replayed at the discretion of the head referee only for a failure of a non*Team* supplied *Game Element* or verified Wi-Fi interference that was likely to have impacted which *Alliance* won the *Match***.**

Unexpected *Robot* behavior will not result in a *Match* replay. *Team*-induced failures, such as low battery conditions, processor sleep time-outs, *Robot* mechanical, electrical, software, or communication failures, etc. are NOT valid justifications for a replaying of a *Match*.

If a match does need to be replayed, the FTA must present their case to the head referee, as soon as possible. The head referee will make a final decision on the replay of the match.

Non-Allowed Wi-Fi Communication

Rule **<C12>** can be located in the Game Manual Part 1. It is important for the FTA to read and understand this rule and how to interpret potential violations.

[1] Adapted from the "Robot Inspection for FTC" app developed by Team HazMat: FTC 9277 and 10650.

Wireless Communication - No Team, Team member, or Competition attendee can set up their own Wi-Fi 802.11 (2.4GHz or 5GHz) wireless communication in the venue. Non-allowed wireless communications include, but are not limited to:

a. Cellular hot spots (for example, cell phones, tablets, MiFi).

b. Ad-hoc networks.
c. Communication between portable Nintendo consoles.

d. Bluetooth communication with Robots in the Competition Area. No Team, Team member, or Competition attendee shall interfere with a Team's Wi-Fi communication with their own Robot.

The Penalty for violating rule is disqualification of the entire Team from the Competition and their removal from the venue property. Teams may not appeal the Penalty and no refunds will be given for registration fees, prepaid meals, etc. FIRST may conduct a post-Competition review and decide if any added Penalties will be imposed on the offending Team. Teams are encouraged to report wireless security vulnerabilities to the field technical advisor (FTA) at a Competition. Teams should always keep in mind Gracious Professionalism® , and therefore only report valid and verifiable violations of this rule. After the field technical advisor is alerted of a potential rule violation, they will confer with the head referee. The field technical advisor and head referee will further explore the potential violation of this rule. The head referee will work with FIRST Headquarters staff to determine if rule has been violated, and to disqualify the offending Team.

<C12> Rule Interpretation
The head referee will work with the FTA, CSA, and WTA to determine the cause of any un-allowed Wi-Fi communications and to determine if the rule has been violated. Locating the source is an important step when notified of a possible violation of this rule. There are times when an audience member could inadvertently violate this rule, without knowledge or intent to cause harm. It is important for the FTA, WTA, CSA, and the head referee to evaluate the situation and to conclude whether or not the interference was intentional. The final determination to disqualify a team or not will rest with the head referee with the guidance of *FIRST* headquarters staff if the head referee's recommendation is to disqualify the offending team.

<C12> & <C13> Rule and the Robot Controller Hosted Development Tools
The *FIRST* Tech Challenge Blocks Programming Development Tool and *FIRST* Tech Challenge OnBot Java Programming Tool lets teams use a web browser to edit their op modes directly on the robot controller. The tool is hosted by the robot controller and it requires that a team connect their laptop to the robot controller's Wi-Fi network. This Wi-Fi network is the *same* wireless network that the driver station uses to communicate with the robot controller. The use of the *FIRST* Tech Challenge Blocks Programming Development Tool or *FIRST* Tech Challenge OnBot Java Programming Tool does not violate rule <C12> or <C13> if this is done in the pit area, and not the competition area.

Resetting a REV Control Hub WiFi Password
A common issue for teams is resetting the password for the REV Control Hub WiFi password to a new value which is required as part of field inspection.

On the Driver Station app, go to the three dots (...) and select "Program and Manage"
Wait as it may take some time to load. (~30 seconds).

Follow steps from Updating a Control Hub - REV Hardware Client (revrobotics.com) to update:

- Select three lines in upper right-hand corner.
- Select “Manage” from the that pops up.
- Scroll-down to Wi-Fi Settings and enter new password twice in the input fields
- Make sure to write down the password somewhere for safekeeping.
- “Select “Apply Wi-Fi Settings”
- Unpair and re-pair the RC and DS.

FTC Scoring (cloud) and FTC Live (local) System

Before traditional events, scorekeepers/event admin are responsible for working with the Program Delivery Partner (PDP) for event configuration in FTC Scoring, setting up, testing, and operating the FTC Live scoring software for traditional events. This may also be the responsibility of the tournament director, technical director, field supervisor or FTA. The FTC Live scoring software MUST be pre-loaded with teams, leagues (when applicable) and other event configuration information. Review the transfer of the data from FTC Scoring (cloud) to FTC Live in the Scorekeeper section on the website. This transfer should happen within three days prior to the event. Test the software systems and logins at least a week prior to the competition. The Scoring System should be tested again during load-in and the morning of the competition. The FTA should verify that the lead scorekeeper successfully completed these pre-competition tests and that the system is good to go the morning of the competition. The scorekeeper(s) may encounter issues during the competition requiring the FTA’s assistance. Prepare for competition day by reading the Scorekeeper Manual and Event Admin Scoring System Guide. A week prior to the event, check the Github Scorekeeper Repo to see if there are any updates to FTC Live version releases and the cloud-based FTC Scoring for traditional and hybrid event configuration. You may have to contact the region’s Program Delivery Partner or event admin for more FTC scoring related details.

Dealing with Team Issues/Concerns

FTAs and FTAAs will encounter a variety of issues on and around the competition playing field. A few common scenarios are described below:

Unexpected Robot behavior:

One of the FTA’s responsibilities is to determine if unexpected robot behavior is caused by a problem with the Android-based control system, robot, or the Wi-Fi environment. Notify the head referee and the affected team(s) once the source of the problem is identified. When robot error is the cause of the unexpected match behavior, it is very important that the FTA or FTAA explain to the drive team exactly what caused the problem and if time permits, suggest a course of action to fix the robot. Spending a few minutes helping a team will make a huge difference in the team’s event experience. It is best to identify the source of the problem, share your findings with the team, listen to the team’s feedback, and then move on to the next match. If the team needs additional troubleshooting help, direct them to the event’s CSA if one is available or recommend that the team seek help from veteran teams in the pit area.

Competition rule violation:

A student member of the drive team is not wearing safety glasses in the competition area.

Making eye contact with the student, smiling, and tapping a finger to your safety glasses is a friendly and effective way to keep the student safe and in compliance with the rules. Non-verbal cues are a great alternative to using an elevated voice that can be heard over a noisy environment.

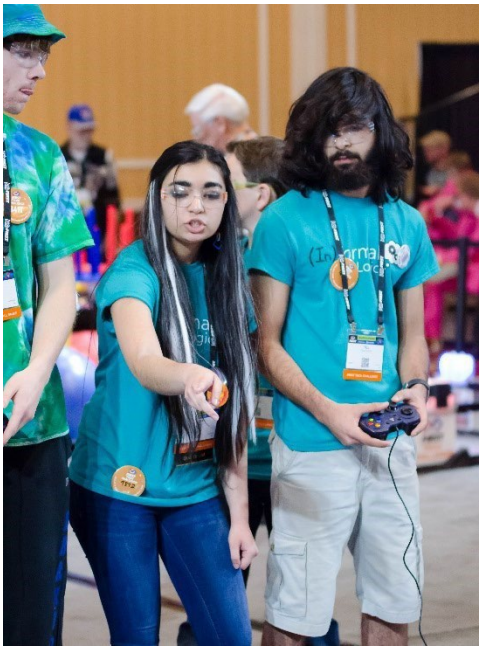
Repairing a robot in the competition area:

A drive team is making last minute repairs to their robot in the queue or on the playing field:

Quietly observe the action to assess the situation before asking the least busy student about their robot's status. As an advocate for teams in need, offer your assistance and advise the drive team on how much time is available before they need to leave the queue or be prepared to start the match. Be as generous as possible with their allowed repair time. Teams put a large amount of time and effort into building their robot to play just five or six matches at an event. Remember, the match schedule is a guide, not a guarantee. Balancing the needs of a team with a broken robot with the goal of running an event on time is a common dilemma for an FTA.

Distracted drive team during pre-match set up:
A drive team is strategizing with their alliance partner when they should be setting up their robot for a match.

Move close to the drive team to get their attention and gently guide them towards setting up their robot for the match. After the robot is ready for the match, suggest that a better time for planning the alliance's match strategy is while they are in the pit area or queue.
There will probably be a scoring dispute or a field issue that a team may have during your event. The FTA's job is a factfinder and robot repair expert, not a person to answer feedback and take complaints. There are ways to present your issues to a team that helps them to solve their issue or accept a ruling that can make your life easier and make the team feel that you are truly there to help them solve their problem. Simply listening to a team's issue is often what is needed to smooth over a situation.



Common questions asked by teams and suggested responses

Q1: Why aren't you going to replay that match?

A1: *There are only certain situations that warrant replaying a match. Unless we can prove that it was a field fault or Wi-Fi interference, we cannot replay a match.*

Q2: Why did you replay a match for someone else, but not us?

A2: *Explain the team's situation versus the other situation. How were they different?*

Q3: Why won't you fix that score? We have video (or photographs) to prove the score is wrong! (This is not a question for the FTA to answer. Scoring questions should always be deferred to the head referee).

A3: *Direct the team to the question box so that they can discuss this issue with the head referee. Note that referees cannot accept video replay as per <C02>.* Referees have final gameplay and scoring authority during the Competition. Their rulings are final. The referees will not review any recorded Match replays or photographs.

Q4: Why don't you fix/cleanup the wireless environment? It's obvious that the wireless environment is disruptive and causing disconnects.

A4: *We have been monitoring the field's wireless channel throughout the day and then state the relevant facts about the wireless environment for the competition.*

Q5: The scoring referee incorrectly recorded our match scoring performance. What should we do?

A5: *Suggest that a team representative stand in the Referee Question Box to discuss this issue with the head referee.*

End of the Day

At the end of the day, walk away from the event knowing you have done your absolute best to be an exemplary role model and ensure that the competition was fair for all teams. These are the ultimate goals of the *FIRST* Technical Advisor position.

Season Changes and Topics for Emphasis: Electronic Inspection Checklists and Team Status Tracking: Automated inspection checklists and team status tracking are available in the *FIRST* Tech Challenge Live Scoring System. Inspectors can use tablets or computers connected to the scoring system network to complete the inspection checklists and track team inspection status. See the Scoring System documentation for the complete details.

FTA Notes: The FTC Live scoring software has an optional FTA user role to be used on a tablet to take notes on specific teams throughout the event. Please refer to the Scorekeeper Guide Appendix on FTA Notes.

OpMode Initialization: Pre-Match execution of the OpMode initialization code is required for robots participating in the autonomous period.

Robot Sensor Calibration: Teams require a brief period on each of the competition playing fields to calibrate their robot's sensors under competition lighting conditions. Events may specify a window of time for sensor calibration or teams may have extra time during Field Inspection to collect sensor calibration data. The tournament director and lead field inspector will select the time for robot sensor calibration.

Qualification Match Schedule: The FTA's mindset should be schedule aware, not schedule driven. Occasionally delaying a match to assure that all four robots participate is usually worth the impact on the schedule.

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 Tech Challenge Event On-Call Support

The on call event support number is available for event personnel only. Please **do not** call these numbers if you are a team looking for a ruling, a decision, or assistance. We trust that you will not misuse this resource.

- Scoring System and Robot Control System on call event support: 603-206-2450
- All other day of event support: 603-206-2412

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!