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2023-2024 *FIRST*® Tech Challenge

Control System Advisor

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Raytheon Technologies

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*!

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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.

Introduction to Control System Advisor

Job Description

The Control System Advisor (CSA) is a volunteer who helps teams with robot control system related issues. The CSA works in collaboration with the *FIRST* Technical Advisor (FTA), Robot Inspectors, and Field Inspectors who may direct teams experiencing issues on the field or in the pits to the CSA for help. This position requires a high level of technical knowledge and people skills, and is a major contributor towards assuring that all teams have a successful event. While some smaller events combine the Control System Advisor and *FIRST* Technical Advisor responsibilities, having separate volunteers for each role is recommended to keep the workload manageable. *FIRST* Tech Challenge tournaments 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 tournament day, as well.



Prerequisite for CSA Role

To serve as a CSA, in-depth knowledge of the *FIRST* Tech Challenge Android-based control system and diagnostic tools is required.

- **Physical/Technical Requirements:**
 - Technical – High
 - Physical – Low – Role can be performed seated or standing.
 - Administrative – Medium
 - Communication – High
- **Time commitment:**
 - Training – About four to six hours
 - Event Day – About eight hours
- **Proper Safety Attire:**
 - Wear comfortable, closed-toe and closed-back shoes, most of the day will be spent moving between the pit area and the competition fields.
 - ANSI Z87.1 certified safety glasses are required in the competition and team pit areas.

Volunteer Training and Certification

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.

The CSA should read this manual before the event. They should speak to the tournament director or affiliate partner to check for additional requirements, such as meetings or calls before the event. The estimated training time is four to six hours.

Volunteer Minimum Age Requirement

FIRST requires that FIRST event volunteers be at least 13 years old, however, the Regional Planning Committee can *increase* the age requirement, as needed. Adult volunteers cannot have children with them while volunteering nor be responsible for supervising children at the event. Children under the minimum age are welcome at FIRST competitions with suitable supervision by someone other than a volunteer.

WTA and CSA Minimum Age Requirement

The minimum age allowed for a Control System Advisor (CSA) and a Wi-Fi Technical Advisor (WTA) is 18.

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 simple 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!

Pre-Event Day Responsibilities

It is important that before the event, the Control System Advisor reviews the CSA Manual and reads the supporting documents listed in the checklist below. These training materials will help CSA's learn how to provide effective technical support to teams.

The training materials provide the technical knowledge needed to help teams and the scheduled FTA/CSA discussion calls provide an opportunity to ask questions and share ideas.

FIRST Tech Challenge technology requires knowledge of the robot electronics and behaviors unique to the program. Completing the pre-tournament checklist below will help CSA prepare for their important volunteer role.

Outlined below are the responsibilities and documentation a CSA should complete 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 checklists. An electronic or printed copy of this guide will be helpful on tournament day for the technical element references it provides.
- Read the [CSA 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 tournament day for the technical element references it provides.
- Read the [FIRST Tech Challenge WiFi Guide](#) and [WiFi Event Checklist](#) in case you are asked to help assess and oversee the Wi-Fi environment.
- Read the [Wi-Fi Technical Advisor Manual](#) if you will also cover this important volunteer role.
- Read the [FIRST Tech Challenge Robot Wiring Guide](#).
- Watch the game reveal video at [\(1\) FIRST Tech Challenge - YouTube](#). 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](#) and read "The Competition" section to become familiar with the tournament terminology and structure. It would be beneficial to also read "The Robot" section for the robot construction rules and the [Game Manual Part 2](#) to learn the game rules.
- Take part in the monthly FTA/ CSA discussion calls or listen to their recordings. The call schedule and recordings are in the Control System Advisor folder in the learning management system (LMS), [BlueVolt](#).
- Read the FIRST Tech Challenge Technology Forum <https://ftc-community.firstinspires.org/> FIRST staff will respond to posts and share tips and important technical information in this forum.
- Before event day, the WTA or CSA should conduct a wireless survey of the venue to make sure the wireless environment is clear and there are no Wi-Fi suppressors running. 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 and the FTA. The CSA can 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 Wi-Fi Direct robot communications, FTC 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 FTA.
- Learn how to Manage and connect the REV Control Hub here: <https://ftc-community.firstinspires.org/>
- Troubleshoot the REV Control Hub here: <https://github.com/FIRST-Tech-Challenge/FTCRobotController/wiki/Troubleshooting>
- Detailed REV Robotics Control System information and troubleshooting tips are located here: [Introduction - DUO Control System \(revrobotics.com\)](https://www.revrobotics.com/learn/duo-control-system/)

Event Day Responsibilities

Tournament Set-Up Day for the CSA

- Dress for the day includes safety glasses or side shields on shatterproof prescription eyeglasses as they are required around the competition playing fields and in the pit areas. Comfortable clothing that will allow you to move easily and closed-toed and closed-backed shoes that will not harm the foam playing fields floor covering are also required.
- Tournament set-up 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, although those times will decrease with experience. If a WTA is not available, the CSA or FTA will survey the wireless environment in the competition area and practice area. It is helpful to have a pair of Android devices running the *FIRST* Tech Challenge apps (*FIRST* Tech Challenge Driver Station and *FIRST* Tech Challenge Robot Controller) to test the wireless environment on the playing field(s).
- Be sure to have all passwords of the computers or devices being used, if applicable.
- The Android-based robot control system does not need any centralized control infrastructure. Teams will bring their own driver stations and robot controllers to the event which will help to avoid troubleshooting wireless issues immediately before an event. Feel free to contact the FIRST HQ on-call technical support line 603-206-2450 if there are any problems with the setup or the wireless spectrum on event day at firsttech@firstinspires.org. The *FIRST* Tech Challenge affiliate partner or the tournament director will also have the telephone number for the on-call technical expert. Ask for this telephone number before you need it and have it handy.

Event Day for the CSA

- Arrive early; the CSA should be one of the first volunteers to arrive on event day.
- If the event does not have a WTA, the CSA or FTA should verify the reserved wireless channels for the competition are clear and that low ping times are observed for a test robot controller-driver station (RC-DS) pair running on these channels.
- Help with field inspection when not helping a team.
- The rest of the day will be spent helping teams that are in the queue or pits preparing for their match, or those who have technical issues that cannot be resolved by an FTA.
- **Note:** Even though the CSA's role is to provide more in-depth technical support to teams and mentors, the CSA's should still prioritize support issues to make sure they are addressing the most critical issues in a timely manner to help as many teams as possible.
- CSA's in the on-deck queue for a playing field perform the following activities to help teams prepare for a match:
 - Verify that the Driver Station (DS) and Robot Controller (RC) Android devices are communicating wirelessly, the gamepads are communicating with the DS, DS USB cables are untangled, and an OpMode is selectable on the DS.
 - Provide assistance, as needed.
 - Confirm that the robot main power is turned off during transport to the playing field.
 - If robots are assigned to specific Wi-Fi channels, verify that the DS and RC are using the correct Wi-Fi channel.
- The CSA might also be consulted to troubleshoot potential wireless issues, such as wireless interference or possible malicious activity on the wireless spectrum.

Suggested Event Day Equipment & Document List for the CSA

- Safety glasses are required.
- Small battery-powered flashlight or headlamp.
- Multifunction Voltmeter/Ammeter/Ohmmeter with probes.
- A pair of FTC-approved Android devices.
 - Current *FIRST* Tech Challenge Driver Station App installed on one smartphone or the REV Driver Hub.
 - Current *FIRST* Tech Challenge Robot Controller App installed on the other smartphone or a Control Hub
 - Wi-Fi Analyzer app (available from the Google Play Store) installed on an Android smartphone.
- Windows laptop with Android Studio, *FIRST* Tech Challenge SDK, REV Hardware Client, and an enhanced editor like [Notepad++](#) installed.
- USB-A to Mini USB Cable.
- USB-A to Micro USB Cable.
- USB-A to USB-C Cable.
- If a computer with the REV Hardware Client is unavailable, the following items can replace some of the functionality:
 - USB flash drive with the current *FIRST* Tech Challenge Driver Station and Robot Controller apps (.APK files)
 - USB OTG adapter to allow plugging the USB flash drive into an Android device for side-loading software.
- Hard copy or electronic copy of the CSA Manual.
- Hard copy or electronic copy of the CSA Troubleshooting Guide.
- Hard copy or electronic copy of the Wi-Fi Event Checklist.

Non-Allowed Wi-Fi Communication

This rule is in the [Game Manual Part 1](#). It is important for the CSA to read and understand this rule and how to interpret potential violations.

<C12> 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 the 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 *FIRST* Technical Advisor (FTA) at a Tournament. Teams should always keep in mind Gracious Professionalism®, and therefore only report valid and verifiable violations of this rule. After the FTA is alerted of a potential rule violation, they will confer with the head referee. FTA 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 decide if the rule has been violated. Finding the source is an important step when notified of a possible violation of this rule. There are times when an audience member could accidentally 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 decide whether 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 OpModes directly in 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 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> as long as this is done in the pit area, and not the competition area.

Match Replays

The most important role of the FTA is correctly diagnosing the problem and working with the head referee to decide if the issue will cause the match to be replayed. The FTA will likely consult with the WTA and/or CSA when wireless interference is suspected. Matches should be replayed if the issue or problem can be **absolutely traced back to excessive wireless interference**. Issues caused by the team's robot do NOT warrant a match replay.

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 or Field Element or verified Wi-Fi interference that was likely to have impacted Match Scores for Qualification Matches or which Alliance won the Match for Elimination Matches.

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, WTA, and possibly the CSA 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.

CSA Robot Triage

If there is a robot issue on the field the FTA cannot resolve in a timely manner, the team who is experiencing the issue will be directed to the CSA for support. The CSA should work with the team away from the competition area to help diagnose and resolve the technical issues. When problems arise, the CSA should troubleshoot with the following guidelines:

- Ask the team to describe their robot's unexpected behavior.
- Check the status of the robot by visual inspection of the robot, the robot controller, and the driver station.
- Check the status of the robot by viewing the log file on the robot controller and possibly on the driver station. Note that this might require (with the team's permission) the CSA connect the Android devices to a laptop.
- Check the voltage level of the robot controller, driver station, and main robot battery.
- Check the wiring of the electronic modules.
- If necessary, look at the source code of the team's Op Modes.
- Recommend corrective action to the team.

Consult the CSA Troubleshooting Guide for details on the available tools that can be used to troubleshoot a problematic robot.

The CSA may spend extended time helping a team, but if there are multiple teams who need in-depth assistance, the CSA should rank the issues and try to provide support to as many teams as possible.

While the CSA is working with the team, they should suggest the other members of the team watch the match schedule while they are troubleshooting the problems with the robot.

Even if the robot cannot function, it is important that at least one team member be in the competition playing field alliance station for each match. If not, they will not be credited with the results of the match. In some cases, just having the robot on the field can score points even if it does not function.

Dealing with Team Issues/Concerns

One of the CSA's responsibilities is to decide if unexpected robot behavior is caused by a problem with the Android-based control system, robot, or the Wi-Fi environment. Tell the FTA 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 important the CSA explain to the team exactly what caused the problem and if time allows, suggest a course of action to fix the robot. Spending several minutes helping a team will make a dramatic difference in the team's event experience. It is best to identify the source of the problem, share your findings with the team, and listen to the team's feedback. The CSA's role at an event is to provide more in-depth support to teams than the FTA has time to offer. If multiple teams need help, then the CSA will need to prioritize the cases and work efficiently to try to provide in-depth technical support for all the affected teams.



The CSA's job is to help teams with their robot's technical issues, not a person to answer and take complaints. There are ways to present issues to a team that helps them to solve their issue or accept the match play ruling.

that can make your life easier and make the teams feel that you are 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 are shown below:

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? If the team still has questions, suggest that they talk with the head referee in the competition area Question Box.*

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 CSA to answer, but one for the referee to answer officially. Scoring questions should always be deferred to the Head Referee).

A3: *Direct the team to the question box so they can discuss this issue with the head referee. Note that referees cannot accept video replay as per Section 3.5 Rule <C02>, a - The referees will not review any recorded match replays or photographs.*

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

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

Q5: The scoring referees scored our match wrong, or they put the wrong score into the computer. (This is not a question for the CSA to answer, but one for the referee to answer officially. Scoring questions should always be deferred to the head referee).

A5: *Teams may formally protest a match for a period of time not to exceed three matches following the match in question. If a team wants to dispute a score, one student representative should wait patiently in the designated Question Box area for the head referee (do not interrupt matches for this conversation). If the referees agree that they made a mistake, they can correct it. If the referees are confident in their score, the team should accept that decision.*

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 provide in-depth technical support to ensure that the competition runs smoothly for all teams. These are the most important goals of the CSA position.

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 username and password for your team.

Volunteer Forum

Technical Volunteers can sign up here ftc-community.firstinspires.org. 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 Eastern Time

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!