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2019-2020 FIRST® Tech Challenge

Wi-Fi Technical Advisor

Manual
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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 5,500 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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<th>Revision</th>
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<tr>
<td>1</td>
<td>5/16/2019</td>
<td>New cover and manual template</td>
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<tr>
<td>1.2</td>
<td>6/04/2019</td>
<td>Spacing and text edits</td>
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<tr>
<td>1.3</td>
<td>6/20/2019</td>
<td>Removed language referencing the Schoology LMS</td>
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<tr>
<td>1.4</td>
<td>08/05/2019</td>
<td>Updates, formatting, structure changes by field expert</td>
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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. 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 Description”.

Job Description

Introduction
The Wi-Fi Technical Advisor (WTA) is a volunteer who helps a Tournament Director plan for large FIRST Tech Challenge (FTC) events. The WTA is also responsible for monitoring the wireless spectrum and troubleshooting wireless issues at large and/or critical FIRST Tech Challenge events. This position requires a high level of technical knowledge and interpersonal skills and can affect the quality of the event.

Not every FIRST Tech Challenge event will require a WTA. Most smaller events (less than 40 robots) do not require the skills of a WTA. However, events with many robots (greater than 40 robots), or events that have difficult wireless conditions or where malicious wireless activity might occur would benefit from having a designated WTA available.

- Physical/Technical Requirements:
  - Technical – High
  - Physical – Low
  - Administrative – Medium
  - Communication – High

- Time commitment:
  - Training – Approximately four to six hours
  - Event Day – Approximately eight hours

- Proper Dress:

Gracious Professionalism® - “Doing your best work while treating others with respect and kindness - It’s what makes FIRST, first.”
• Wear comfortable, closed-toe and closed-back shoes. Most of the day will be spent standing and walking between the pit area and the competition fields.
• ANSI Z87.1 certified safety glasses are required in the competition and pit areas.

**Volunteer Training and Certification**
Volunteers must apply to their role using the Volunteer Registration System. After the volunteer has applied to their role, FIRST Tech Challenge will send an email to the volunteer with access instructions to training and certifications (if applicable). Emails with access to the training and certifications will be sent within one business day from applying to the role. If you have applied for a role but have not received access to the training, please email FTCTrainingSupport@firstinspires.org.

The **Wireless Technical Advisor** 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 before the event. The estimated training time is four to six hours.

**Wi-Fi Technical Advisor Selection**
The Wi-Fi Technical Advisor (WTA) role is a very specialized and highly skilled position. Currently, FIRST Tech Challenge does not have a certification process for this specific role since there are only a few events per season which require a WTA. The Tournament Director, with assistance from FIRST, can help identify potential candidates for the role of WTA.

**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 Control System Advisors (CSA) and Wireless Technical Advisors (WTA) is 18.

**Bring a Friend!**
Volunteers are a huge part of the FIRST Tech Challenge Program and continuing 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 head first, 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!
Overview of Responsibilities

The Wi-Fi Technical Advisor is the technical volunteer who helps ensure that the wireless environment at a FIRST Tech Challenge event is clean and not too noisy in order to ensure that teams are able to compete effectively.

Before an event, the WTA might be asked to conduct a wireless network survey to determine if there are potential sources of wireless interference in the venue. The WTA might also be asked to work with the venue’s IT staff to make any appropriate changes to the wireless equipment in the venue to ensure a clean environment for the scheduled event.

During an event, the WTA will be responsible for monitoring wireless activity near the competition field to identify and resolve any wireless issues. The WTA might also need to “police” the wireless environment and look for clues for potential malicious activity during an event. The WTA might also be asked to assist the Field Technical Advisor (FTA) and/or Control System Advisor (CSA) to answer questions that they might have about the wireless environment.

The WTA requires advanced and very specialized skills:

- Experience with Wi-Fi and Wi-Fi Direct networking;
- Experience using tools such as Wireshark, Fluke (NETSCOUT) AirCheck Meter, Aircrack-ng, AirTight Networks SpectraGuard and MetaGeek inSSIDer.
- Recent and in-depth knowledge of the FTC Android-based control system and diagnostic tools;
- Experience/familiarity with computers running the Windows® 7/8/10, Mac OSX, and Linux operating systems;
- Able to use deductive reasoning to solve technical problems.

Pre-Event Day Responsibilities

It is important that prior to the event, the Wi-Fi Technical Advisor (WTA) reviews this WTA Manual, and reads the supporting documents listed in the checklist below. These training materials will help WTAs learn how to provide effective Wi-Fi monitoring and technical assistance for the event. Learning ahead of time will go a long way towards keeping the event running smoothly and on time.

The document names that are underlined are hyperlinks to public documents on the FIRST Tech Challenge website. The remaining documents are stored in the Learning Management System (LMS).

Outlined below are responsibilities that a Wi-Fi Technical Advisor has before event day. Make sure to check with the Tournament Director to see if they need help setting up before the event.

- Print this Manual. Read it thoroughly. Complete all the checklists. Bring it to the competition for technical reference.
- Read the Control System Troubleshooting Guide, which explains how to troubleshoot common problems with the FIRST Tech Challenge Android-based control system. Print this document and bring it to the competition for technical element reference.
- Read the FIRST Tech Challenge Wi-Fi Event Guide.
- Read and complete the FIRST Tech Challenge Wi-Fi Event Checklist.
- 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 and read Section 4, The Tournament and become familiar with the tournament terminology and structure.
It might also be beneficial to read Section 8 for the robot construction rules and the Game Manual Part 2 to learn the game rules, though this is not required.

- Verify with the Tournament Director that a table, chair, and power drop are available in the competition area for you to set up your Wi-Fi monitoring equipment.
- 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, the WTA should do a wireless survey and conduct some wireless tests a week or more before event day. This helps to avoid troubleshooting wireless issues immediately before an event. Feel free to contact the on-call technical support person if there are any problems with the setup or the wireless spectrum on event day. The FIRST Tech Challenge Affiliate Partner or the Tournament Director will have the telephone number for the on-call technical expert which also appears at the end of this document.
- Read the frequently updated Wi-Fi Tech Advisor Discussion Forum located in the new learning management system in the Wi-Fi Technical Advisor folder. 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, share tips, and important technical information in this forum.
- Prior to event day, the WTA 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 and the Field Technical Advisor.
  - The WTA 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. If available, use a tool (such as the Fluke or NETSCOUT AirCheck meter) to measure Wi-Fi and non-Wi-Fi activity in different areas of the venue.
  - If necessary, the WTA should coordinate with local IT staff at the venue in order to turn off any Wi-Fi signals which could be detrimental to the event, particularly for events involving 40 or more robots. Obtain the local IT on-call phone number in the event there is a need to contact them on Event Day.
- 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.

**Important Note:** A Wi-Fi Suppressor or Blocker is a device that disrupts the operation of unauthorized Wi-Fi networks in a venue.

- If a Wi-Fi Suppressor or Blocker is present at an event, then teams will be unable to control their Robots properly.
- The FTA should check for the presence of such a device before the event, then work with the IT staff to disable the device for the day of the scheduled event.

### Event Day Responsibilities

**Tournament Set-Up Day for the Wi-Fi Technical Advisor (WTA)**

- 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. The WTA 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 (FTC Driver Station and FTC Robot Controller) to test the wireless environment on the playing field(s).

- Select the Wi-Fi channels for the competition and share the recommendation with the Tournament Director and FTA.
- Be sure to have all passwords of the computers or devices being used, if applicable.

**Event Day for the Wi-Fi Technical Advisor (WTA)**

- Arrive early; the WTA should be one of the first volunteers to arrive on event day.
- Verify that 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 operating on these channels.
- The remainder of the day will be spent monitoring the wireless environment at the competition field. The WTA should monitor the spectrum to make sure the Wi-Fi channels that are designated for robot control are clear and not overloaded. The WTA should also monitor the spectrum to look for clues of potential malicious activity. Report issues of concern to the FTA.
- The WTA should remember that their primary focus is to ensure that teams are able to control their robots over the Wi-Fi spectrum without interference. When dealing with potential interference (such as a spectator running a portable hotspot) it is better to communicate that goal instead of acting like an enforcer. In this manner, it turns the spectators into assistants in keeping the spectrum clean instead of creating an adversarial situation.
- The WTA may also monitor which channels teams are on and help guide teams to the designated channels.
- The WTA might also be required to help the FTA and/or CSA troubleshoot wireless issues.

**Suggested Event Day Equipment & Document List for the Wi-Fi Technical Advisor (WTA)**

- Safety glasses are required.
- A pair of ZTE Speed Android phones (or another compatible set of approved phones that support Wi-Fi channel changing).
  - Current FTC Driver Station App installed on one phone.
  - Current FTC Robot Controller App installed on the other phone.
  - Current Channel Change App installed on Robot Controller phone. (ZTE Speed only.)
  - Wi-Fi Analyzer app (available from the Google Play Store) installed on the Driver Station phone.
- Laptop that supports wireless Monitor Mode with Wireshark installed.
- If available, specialized Wi-Fi analyzing tools (such as Fluke/NETSCOUT AirCheck Meter, MetaGeek inSSIDer with Wi-Spy hardware, etc.)
- Hardcopy or electronic copy of the WTA Manual.
- Hardcopy or electronic copy of the Control System Troubleshooting Guide.
- Hardcopy or electronic copy of the Wi-Fi Event Checklist.
Non-Allowed Wi-Fi Communication
This rule can be located in the Game Manual Part 1. It is important for the WTA to read and understand this rule and how to interpret potential violations.

<T4> No team, team member, or tournament 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. Nintendo DS peer-to-peer.
d. Bluetooth communication with robots in the competition area.

No team, team member, or tournament attendee shall interfere with a team’s Wi-Fi Direct® communication with their own robot.

The penalty for violating rule <T4> is disqualification of the entire team from the tournament 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-tournament 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 tournament. 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 <T4> has been violated, and to disqualify the offending team.

<T4> Rule Interpretation
The Head Referee will work with the FTA, CSA, and WTA to determine the cause of restricted 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. The guidance of FIRST Headquarters staff is required, if the Head Referee’s recommendation is to disqualify the offending team.

<T4> & <T5> Rule and the Robot Controller Hosted Development Tools
The FTC Blocks Programming Development Tool and FTC 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 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 FTC Blocks Programming Development Tool or FTC OnBot Java Programming Tool does not violate rule <T4> or <T5> 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 malfunction can be **absolutely traced back to excessive wireless interference and if the interference was likely to have impacted the outcome of the match**. Issues caused by the team’s robot do NOT warrant a match replay.

Rule *<G27>* in the Game Manual Part 2 addresses match replays:

*<G27> 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 the outcome of 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/communication failures, etc. are not valid justifications for a replaying of a match.

If a match does need to be replayed, the FTA and WTA 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.

**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 and this decision is up to the Head Referee. 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 don’t you fix/cleanup the wireless environment? It’s obvious that the wireless environment is disruptive and causing disconnects.

**A3:** We have been monitoring the field’s wireless channel(s) throughout the day and then state the relevant facts about the wireless environment for the tournament.

**Q4:** We were seeing high ping times during the match.

**A4:** We have been monitoring the spectrum continuously and state whether you have seen any significant problems. Sometimes the metal of the robot or the field border blocks the signal to the robot. You are allowed to lift up the driver station during the match if you think that is happening.

**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 maintain a clean wireless environment so the competition runs smoothly for all teams. These are the ultimate goals of the Wi-Fi Technical Advisor (WTA) position.
Appendix A – Resources

**Game Forum Q&A**
http://ftcforum.usfirst.org/forum.php
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.

 Volunteers that apply for a specific volunteer role will receive an email from FTCTrainingSupport@firstinspires.org with their username and password to the forum. 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**
These numbers are 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.

Day of Event Robot Control System 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!