



FTC Coaches Workshop - Day 1

Introduction to FTC and Building with TETRIX

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Welcome and Introduction

FIRST Progression of Programs



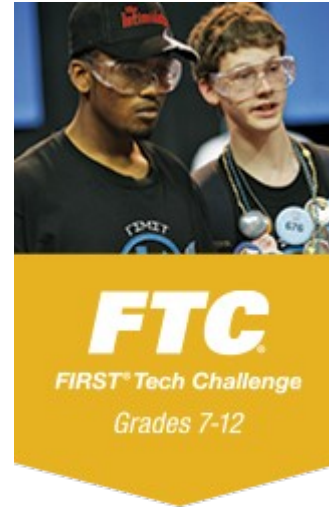
Ages 6-8
11,000+ teams
68,000+ players
100+ expos

LEGO elements



Ages 9-14
32,000 teams
255,000+ players
1297 qualifiers
161 championships

LEGO Mindstorms



Grades 7-12
5,500+ teams
55,000+ players
500+ meets/events

TETRIX/Matrix kits



Grades 9-12
3,357 teams
83,000+ players
100+ meets/events

120 lbs, custom

<http://firstinspires.org/>

FIRST Tech Challenge

Teams design, build, and program robots to compete in an alliance against other teams.



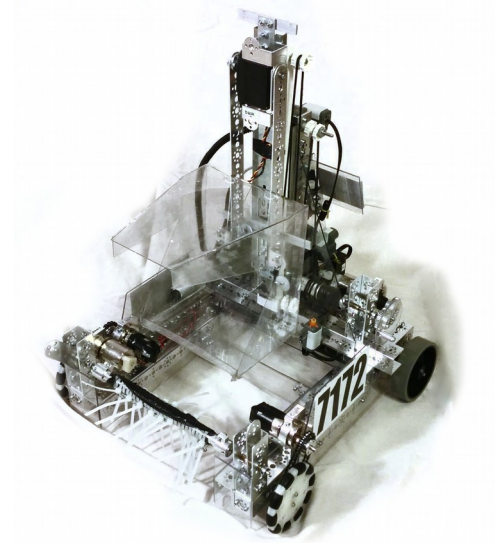
Teams including coaches, mentors, and volunteers develop strategy and build robots based on engineering principles.

FTC competitions occur at regional, state, national, and international levels

FIRST Tech Challenge

Grades 7-12

Up to 15 team members



Robots built using a wide variety of materials and kits of parts

Game challenge changes every year

2011: Bowled Over

2014: Cascade Effect

2012: Ring it Up

2015: Res-Q

2013: Block Party

2016: Velocity Vortex

2017: Relic Recovery

Who is here?

1. Name
2. School / affiliation
3. What do you want to get from this workshop?

FTC Game

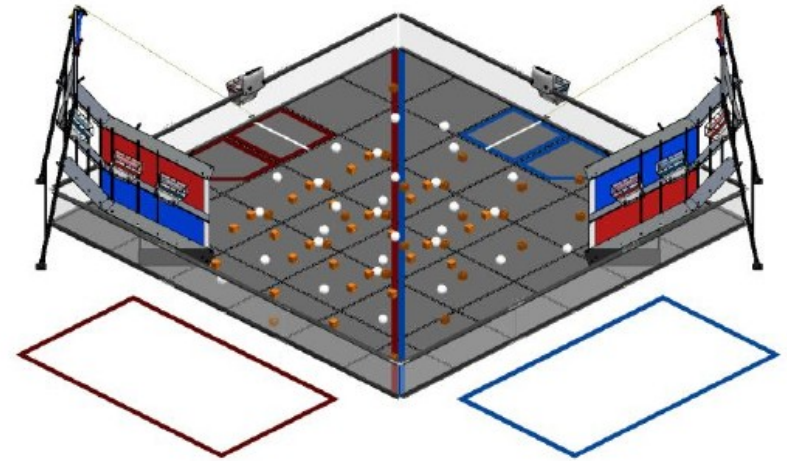
Two alliances of two teams each (four robots)

12' x 12' field with game elements

Robots perform tasks to earn points

30 second “autonomous” portion

2 minute “tele-operated” (driver control) portion including 30 second “endgame”



2017-2018 FTC Season

September - October:

- Coaches clinics

- Scrimmages

November – January:

- Qualifier Tournaments

- League Meets & Tournaments

February: Regional championship

March 8-10: South Super Regionals, Georgia

April: World Championship, Houston

Starting a team – things you need

Registration – firstinspires.org dashboard

Robot

- Control set (phones, gamepads)

- Electronics set (modules, sensors)

- Competition set (hardware, chassis)

- Computer / software

Practice Field

Tools

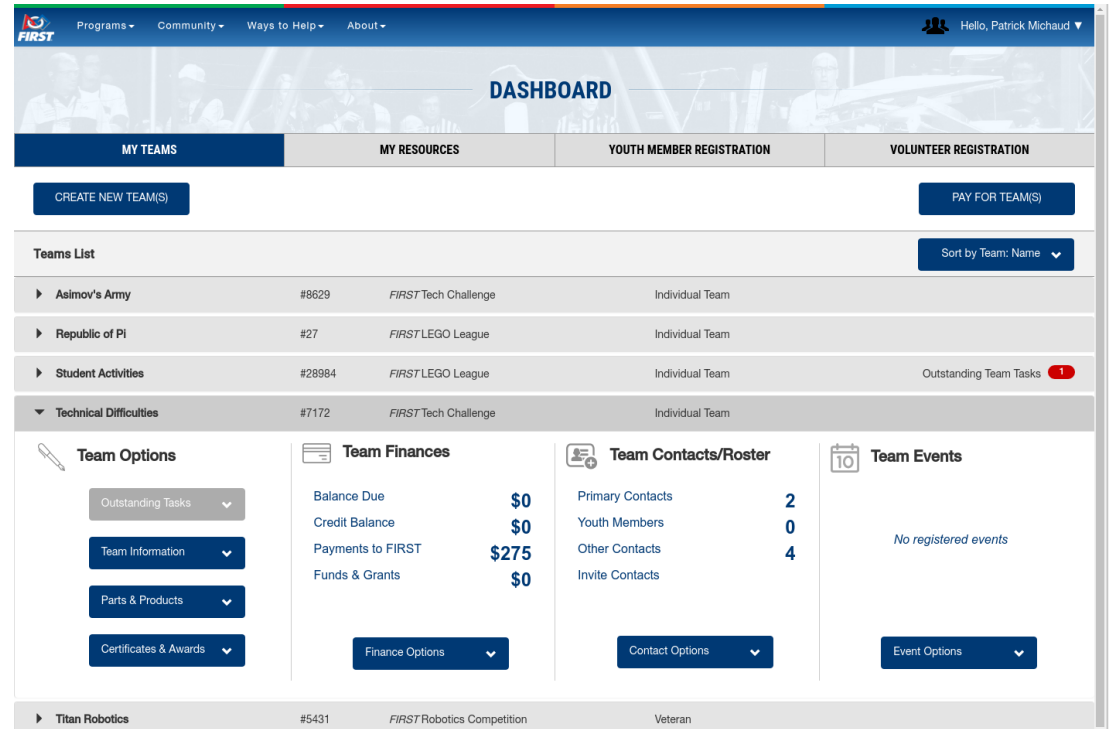
Engineering Notebook

Team Registration - FIRST

Create an account
at firstinspires.org

“Create new teams”

Invite a 2nd coach
(required)



Pay for team registration, receive team number

Don't need to complete team roster until first
event (e.g. meet or qualifier)

Registration and TIMS

FTC Team Information Management System

- Register team, pay registration fee, obtain team number

- Two coaches required

- Purchase robot kits via FIRST

Youth Team Member System

- Team members create an account at firstinspires.org

- Parents electronically sign consent forms

- Apply for team membership

Team coach accepts student applications

- Complete prior to first event

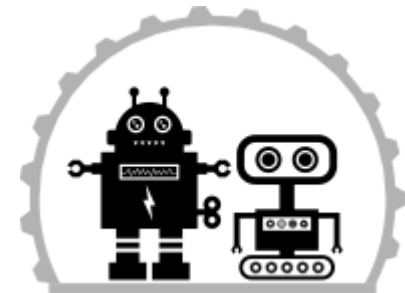
Important things to do

Join NorthTexasFTC Google Group

FTC related discussions, advice, announcements

Bookmark roboplex.org

Calendar of events, resources



Apply for a FIRST in Texas Grant

firstintexas.org



Robot control system

Smartphone based

ZTE Speed

Motorola Moto G phones

Nexus 5



Controllers for motors, servos, sensors

Programming in Android Studio (Java)

Robot-controller app

Driver station app

Robot components

Chassis / mechanical kits

Tetrix, REV Robotics, Actobotics, GoBilda, Matrix

Electronics Set - REV Robotics

Via FIRST Storefront
or revrobotics.com



Control and Communication Sets via FIRST

Option: Gamepads included
or excluded



More robot components

Software development environment

- FTC Robot Controller and Driver Station apps

- Android Studio (Java)

- MIT AppInventor

Other items

- Commercially available hardware and building materials, limited to one degree of freedom

- 3D printed parts

Practice Field

Field sets (game elements) – changes every year

Purchase from andymark.com

Options: Full field set, half-field sets, quarter-field sets

SoftTiles flooring – 2'x2' gray rubber floor tiles

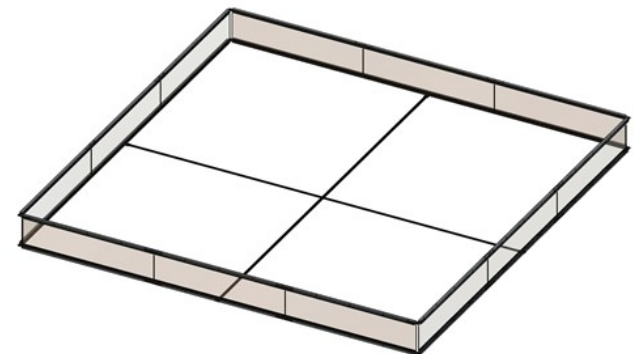
AndyMark: \$230 for a set of 36

SoftTiles.com: \$5.80 per tile = \$208.80
(36 needed for full field)

Field perimeter walls

AndyMark: \$595 + shipping

Build your own or do without



Tools

See roboplex.org for suggestions from teams

Engineering Notebook

Required for winning judged awards

Get started early, don't wait

Document everything you can

Read Game Manual Part I for organization details

See award winning notebooks at FTC site

Engineering Notebook

Required for all judged awards

Documentation of team's robot design and activities for the season:

sketches	processes
discussions	obstacles
team meetings	reflections
design evolution	analyses

Start early, don't wait until just before event

See award winning notebooks at FTC Team Resource

FTC competition

Judged awards

Qualification matches

- Randomly selected alliances

- Teams earn a W-L-T record (QP) and ranking points

Elimination matches (“playoffs”)

- Top four teams from qualification matches become “alliance captains”

- Captains select other teams to form playoff alliances

- Elimination bracket, two wins needed to advance

- Winning alliance and Finalist alliance

Top teams advance to next level

Qualifier events

Single-day competition for up to 36 teams

Robot inspection

Judging

Qualification matches

Elimination matches

Awards

Tournament Day

Judging

Inspection

Qualification matches (5 or 6 per team)

Teams end up with rank based on W-L record

Alliance Selection

Top teams from QM select partners

Elimination matches (playoffs)

Awards & Advancement

7.4 Order of Advancement

1. (optional Qualifier “host”)
2. Inspire Award Winner
3. Winning Alliance Captain
4. Inspire Award 2nd place
5. Winning Alliance, 1st team
6. Inspire Award 3rd place
7. Winning Alliance, 2nd team
8. Think Award
9. Finalist Alliance Captain
10. Connect Award
11. Finalist Alliance
12. Rockwell Collins Innovate
13. Finalist Alliance, 2nd team
14. PTC Design Award
15. Motivate Award
16. Control Award

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Winning and Finalist Alliances

Two ways to be on a finalist alliance:

1. Be an Alliance Captain
2. Be selected by an Alliance Captain

Winning and Finalist Alliances

Two ways to be on a finalist alliance:

1. Alliance Captain

→ One of the top teams after Qualification Matches

2. Selected by an Alliance Captain

→ Reliable, good-scoring partner that complements other teams on Alliance

FTC League Play

Leagues formed of 10-16 teams

Each league has three or more “league meets” over several weeks

- Five or more qualification matches per team

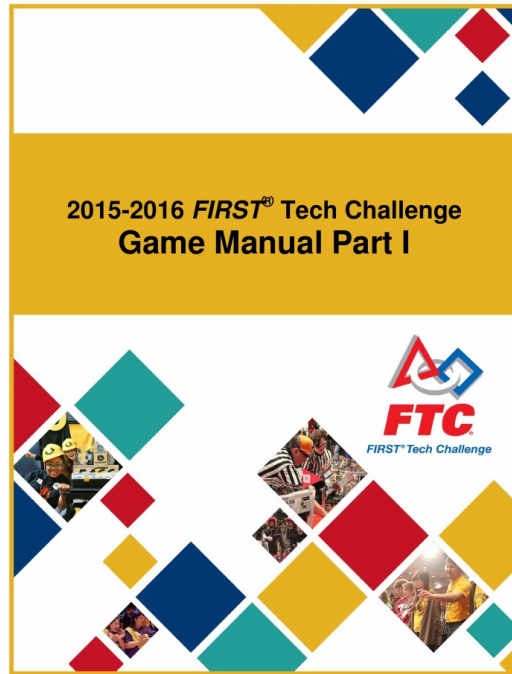
- Engineering Notebook judging

League Tournament event

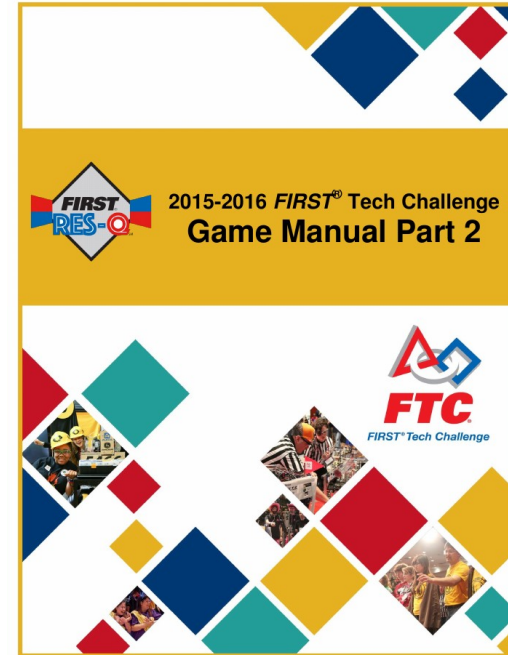
- Teams seeded into elimination rounds based on league meet results

- Judging

Game Manuals



Tournament overview
Robot inspection rules
Advancement criteria
Award descriptions



Game field description
Game rules
Scoring
Penalties



Robot Building using TETRIX

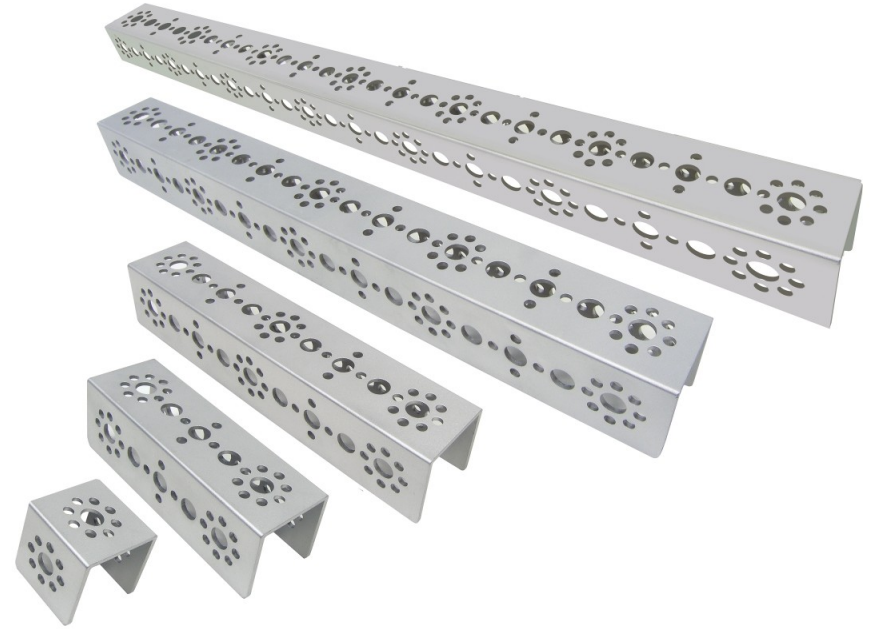
Channels (“C channels”)

Structural base for building robots

Variety of lengths
32mm – 416mm

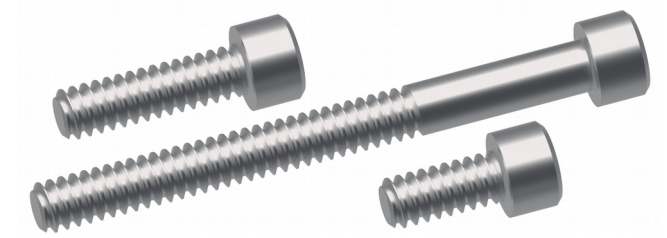
Cut longer channels to
custom lengths

When connecting channels, use at least two
attachment points



Screws

Standard is #6-32 socket head cap screws

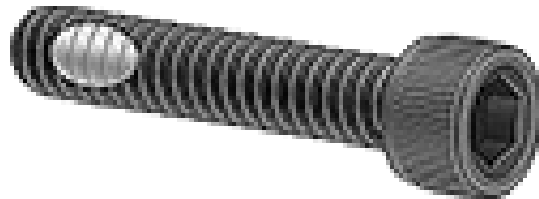


Steel alloy screws

Use a 7/64" hex driver

(hint: color code tools for easy identification)

McMaster-Carr sells nylon lock screws



Nuts

Kep nuts

Have an attached star washer to provide locking

Easy to attach / remove

Often come loose during competition



Nylon lock nuts (“Nyloc”)

Uses a nylon collar insert to hold the nut in place

Requires a (5/16”) wrench to add/remove

Much better locking and hold in competition



Axles, bushings, axle hubs

Axles provide rotary motion

“D-shape” has a flat side for set screws

Bushings allow axles to spin freely in holes

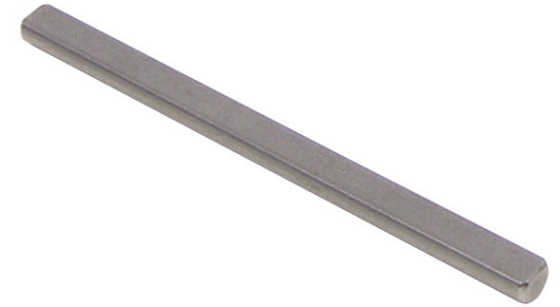
Bronze with embedded lubrication

Best to have axles supported in two spots

Axle hubs attach wheels and gears to axles

Be sure to tighten set screw *only* on flat side of axle

Uses 3/32” hex driver for set screw



Motors

Tetrix DC motors



Stall burnout ~7 sec

\$25 each

Shaft encoder +\$80

Motor power cable +\$2

AndyMark NeveRest



Stall burnout ~180 sec

\$28 each

Encoder cable +\$5

Motor power cable +\$0

Motor mounts

Basic (\$8)



Less expensive

Deluxe (\$16)



More options

Easier to use / replace

Both are designed to clamp onto motor gearbox
Motor shaft offset allows distance adjustment

Motor hubs

Standard



Larger bore than axle hub

Tighten set screw *only* on flat of motor shaft

Can slip in high-torque

AndyMark “Nubs”



D-shaped bore prevents slippage

Set-screw tightens on round part of shaft (?!)

Motor notes

Robot can have maximum of eight (8) DC motors

In general each motor on robot requires:

- * motor
- * motor controller port (on REV hub)
- * motor mount
- * motor hub
- * (optional) encoder cable

Tomahawk robot build

