FTC Coaches Workshop - Day 1
Introduction to FTC
and Building with TETRIX

Patrick R. Michaud
pmichaud@pobox.com

University of Texas at Dallas
August 2017

Welcome and Introduction

FIRST Progression of Programs

Ages 6-8	Ages 9-14	Grades 7-12	Grades 9-12
11,000+ teams	32,000 teams	5,500+ teams	3,357 teams
68,000+ players	255,000+ players	55,000+ players	83,000+ players
100+ expos	1297 qualifiers	500+ meets/events	100+ meets/events
	161 championships		
LEGO elements	LEGO Mindstorms	TETRIX/Matrix kits	120 lbs, custom

http://firstinspires.org/

FIRST Tech Challenge

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

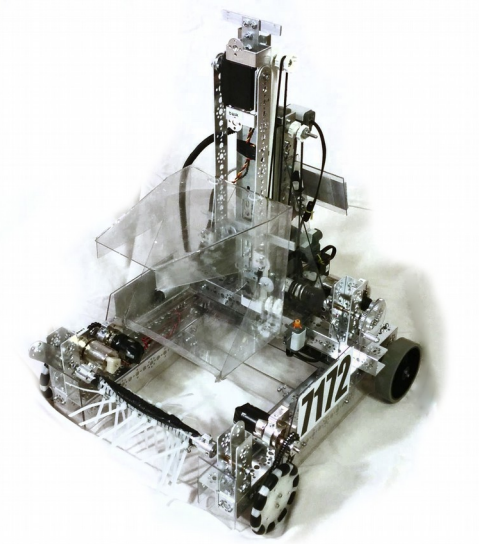
Teams including coaches, mentors, and volunteers develop strategy and build robots based on engineering principles.

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

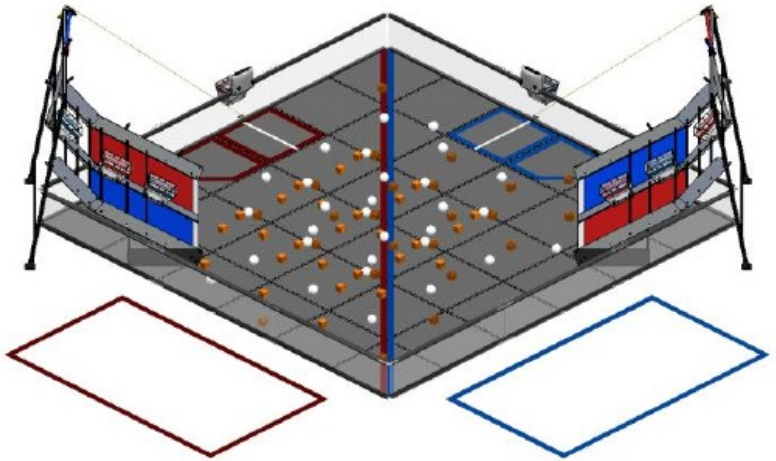
2011: Bowled Over
2012: Ring it Up
2013: Block Party
2014: Cascade Effect
2015: Res-Q
2016: Velocity Vortex
2017: Relic Recovery

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”

2016-2017 FTC Season

September through December:

- Coaches clinics
- Scrimmages
- League meets

January: Qualifiers, League championships

February: Regional championship, UT-Arlington

March: 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

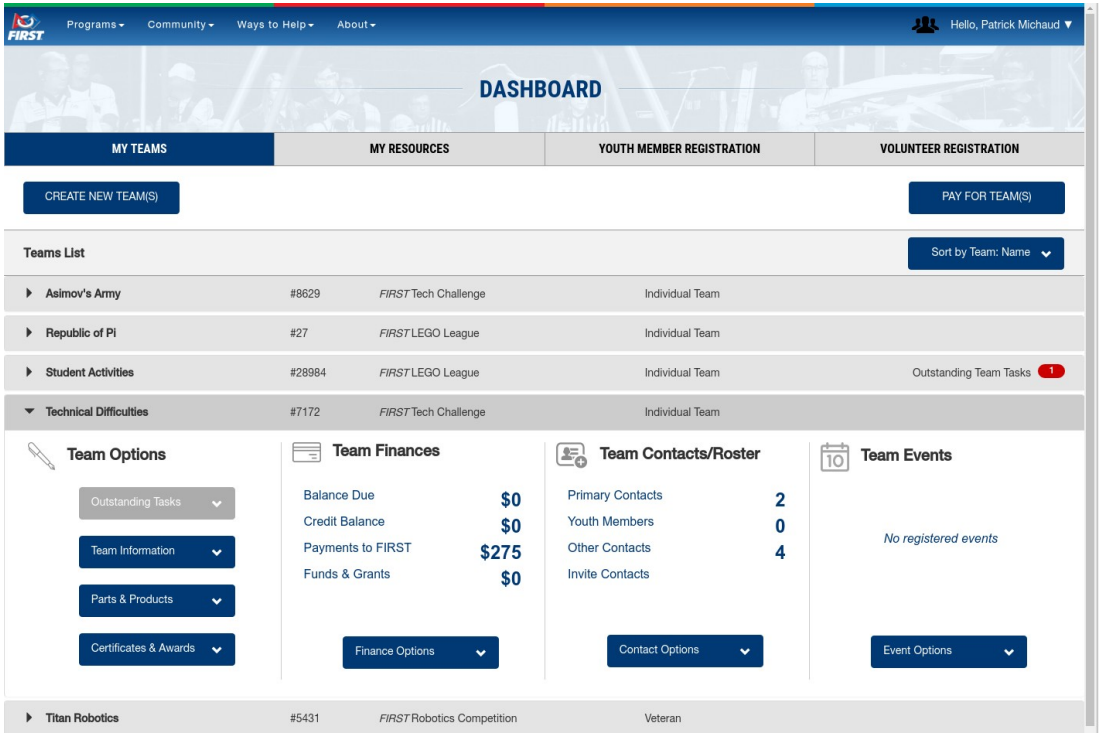
Engineering Notebook

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

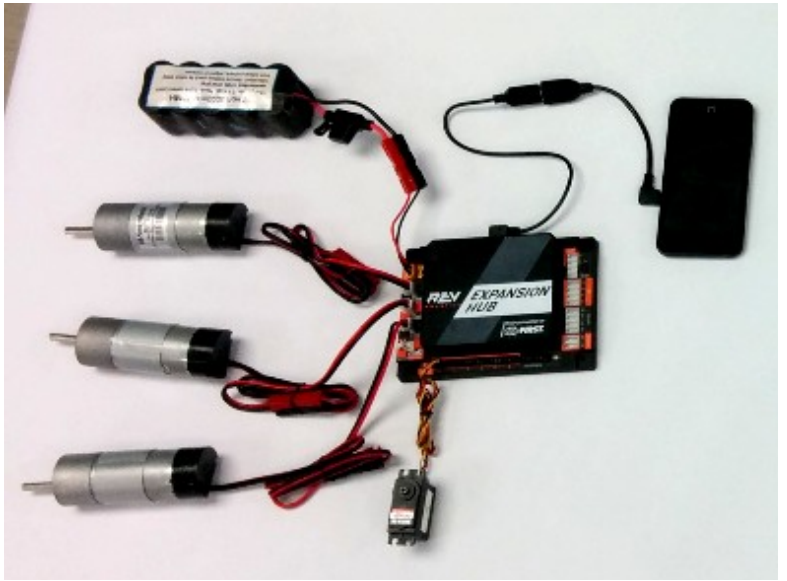
Apply for a FIRST in Texas Grant

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

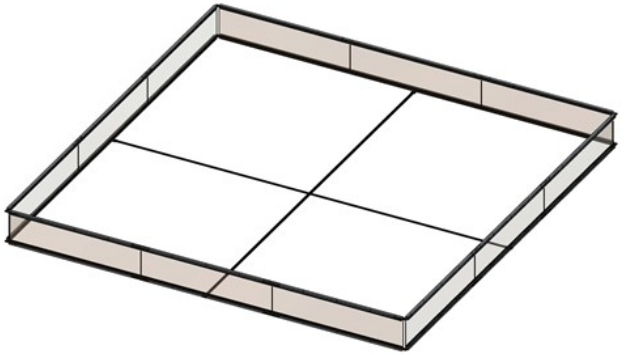
Field sets (game elements) – changes every year

- 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

FTC League Play

Leagues formed of 10-16 teams

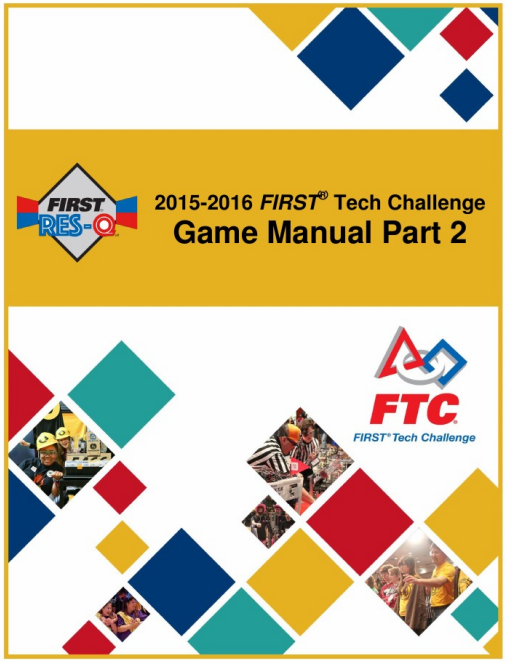
Each league has three or more “league meets” over several weeks

- 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

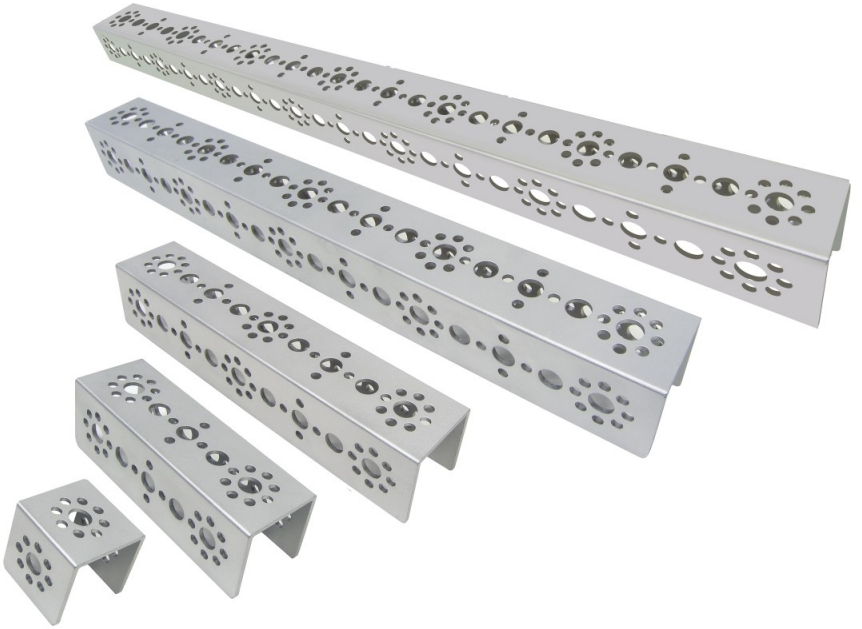
Robot Building using TETRIX

Channels ("C channels")

Structural base for building robots

Variety of lengths
32mm – 416mm

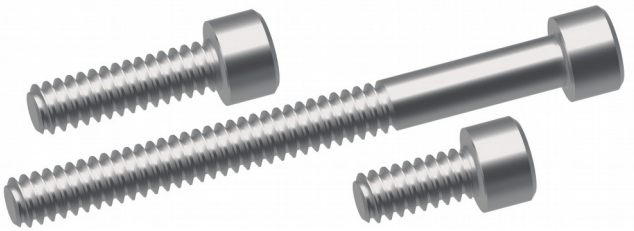
Cut longer channels to custom lengths



When connecting channels, use at least two attachment points

Screws

Standard is #6-32 socket head cap screws

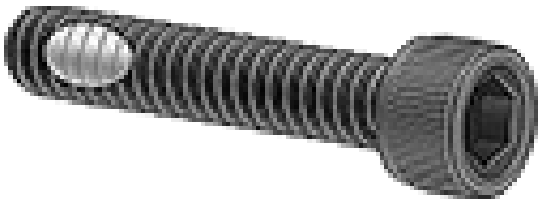


Steel alloy screws

Use a 7/64” hex driver

(hint: color code tools for easy identification)

McMaster-Carr sells nylon lock screws



Nuts

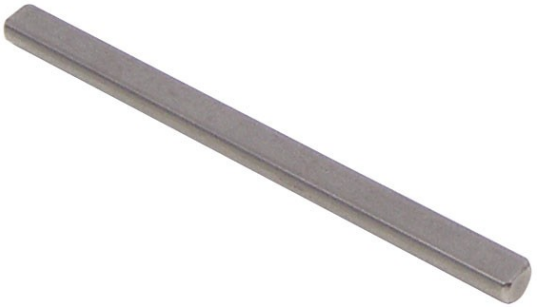
Kep nuts

- 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

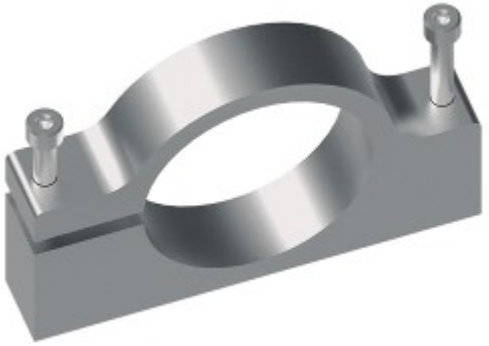
$28 each

Encoder cable +$5

Motor power cable +$0

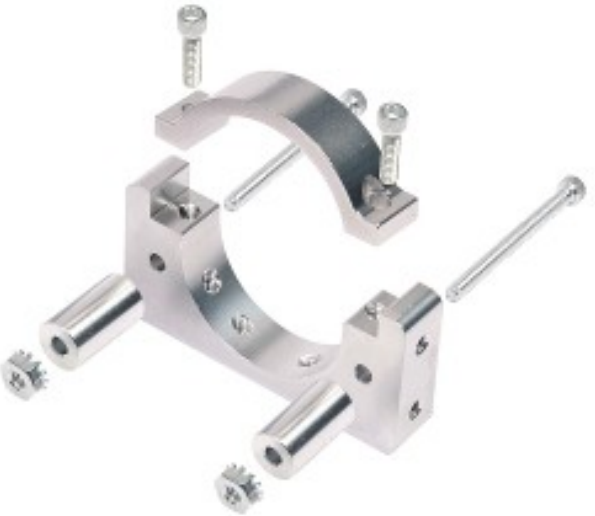
Motor mounts

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