

# FTC Team #11587

## Starry Knights

### Tech Learning Series



## Shooting Mechanisms

# Introduction

- Shooting Overview
- Core Types of Shooter Mechanisms
  - Flywheel
  - Catapult
  - Flicker
- Summary

# Shooting Overview

- Shooting has been a scoring component of FTC competitions for the past 4 years
  - 2016: Velocity Vortex
  - 2015: RES-Q
  - 2014: Cascade Effect
  - 2013: Block Party!

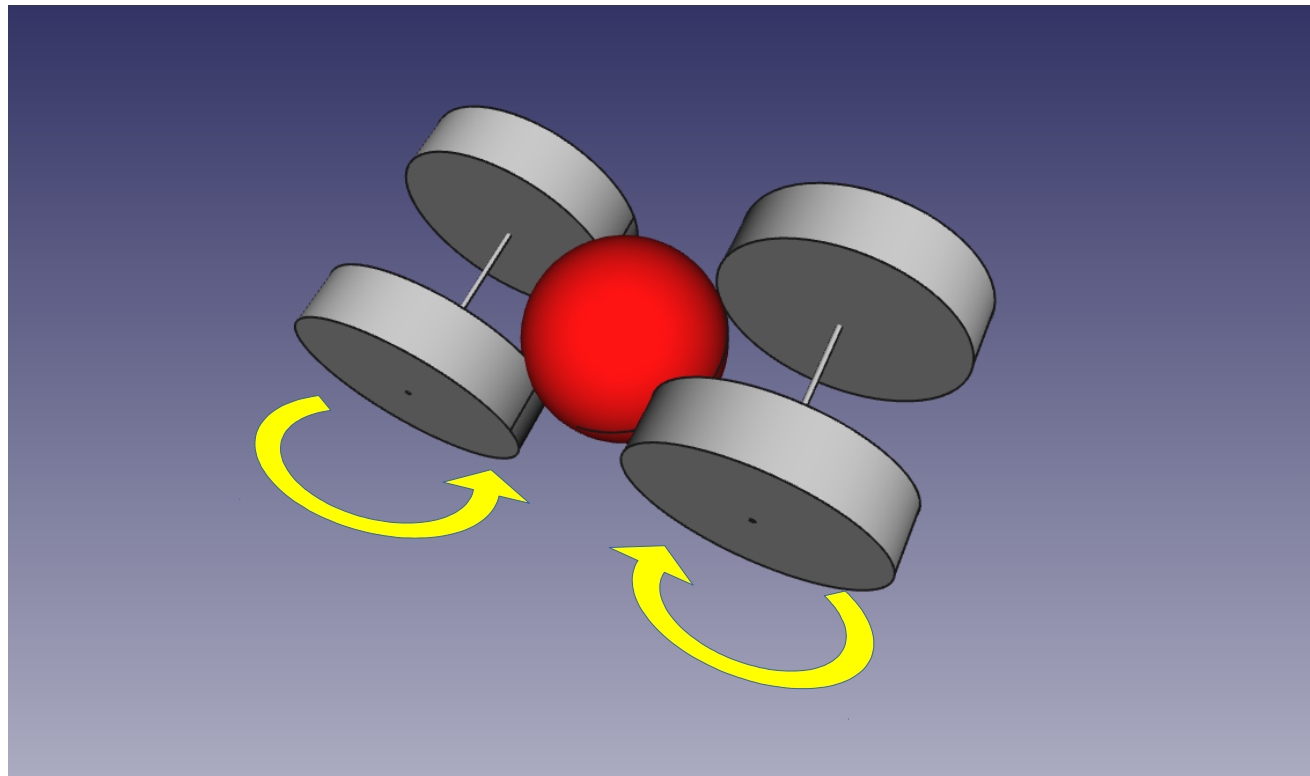


- Objective typically involves getting gamepieces into a goal or receptacle
- Lead-in for more advanced challenges in FRC

# **Intro To Shooter Mechanisms**

# Flywheel Shooter

- Flywheel shooters utilize 2-4 rapidly spinning wheels spaced just far enough apart to provide grip on particle passing between



*Flywheel Shooter CAD Diagram*

# Flywheel Shooter

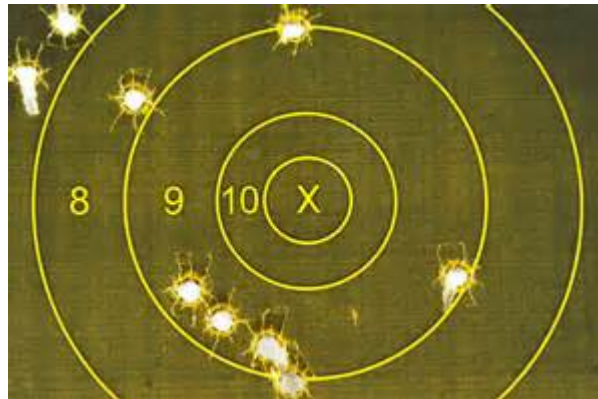
- Pro's
  - Easy to build
    - Wheel / Gears / Axles / DC motors
  - Easy to feed / reload
    - Sweeper / chute feed
- Con's
  - Consistency is poor
    - Exit velocity changes with battery voltage
  - Aiming is difficult
    - Fixed trajectory is most likely due to...
  - Takes up space!



# Flywheel Shooter

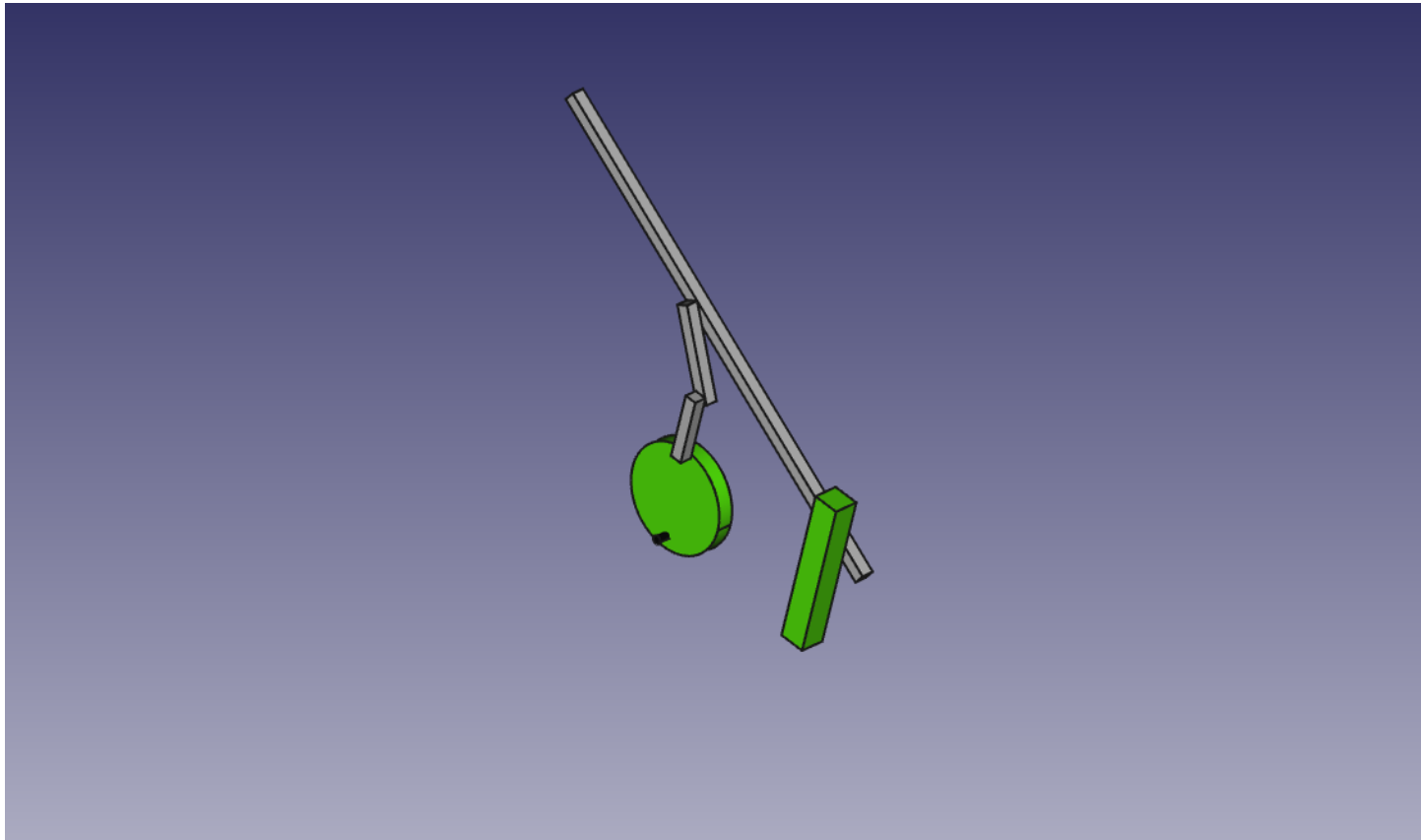
- Design Considerations
  - Gear ratio from drive motor to flywheel needs to be at least 1:5
  - Flywheels must have consistent, grippy surface
  - Good for “mortar” applications – indirect fire
  - Voltage regulator can smooth motor RPM

**BOTTOM LINE: Reliable but needs a lot of attention in the build to make it work**



# Catapult Shooter

- Catapult shooter uses elastic bands, a cam mechanism, and lever arms to launch projectiles



*Catapult Shooter CAD Diagram*



# Catapult Shooter

- Pro's
  - Most accurate / consistent shooting mechanism
  - Able to shoot long distance accurately with right design
  - Quick to reset
- Con's
  - Generally fixed trajectory – adjustable mechanism is complex
  - Can be tough to feed / reload



# Catapult Shooter

- Design Considerations
  - Good for shooting from a known point
  - Surgical tubing good for elastic component
  - Changing lever arm length adjusts velocity / trajectory
  - Will have to carefully design a feeding mechanism for multiple shots

**BOTTOM LINE: Most accurate fixed configuration shooter but complex feed**

# Flicker Shooter

- Utilizes a piece of polycarbonate attached to a spinning holder to “flick” the projectile on a trajectory

# Flicker Shooter

- Pro's
  - Simple to build
  - Reliable
  - Easy to feed
- Con's
  - Fixed trajectory

# Flicker Shooter

- Design Considerations
  - Protect the mechanism from impacts by game objects or other robots – i.e. encase the whole mechanism
  - Build spare replacement components in case of breakage
  - Good for rapid reload / fixed shot tactics

**BOTTOM LINE: Simplest, most reliable shooter – used by many Teams for a reason**

# Video Tutorials

- Shooting Mechanism Overview:

<https://www.youtube.com/watch?v=6OW-YfxOt1Y>

- “Choo-choo” Catapult Mechanism:

<https://www.youtube.com/watch?v=97ruz5Xrqqs>

- Particle Flicker Mechanism:

<https://www.youtube.com/watch?v=ArmfwvATW3c>

# Summary

- Shooting has been a popular robotics task with FTC for the past several seasons – **expect the trend to continue**
- Ballistics calculations are difficult without instrumentation – **trial & error** is generally the fastest way to consistency
- Other methods are also available, but these three have proven to be the most reliable, simplest designs