FTW
ROBOTICS

FTW
ROBOTICS

Required Equipment

Drones differ and are better suited for different uses. During the Drone Competition teams must use specific drones for certain challenges but have options to choose which one they prefer for the FPV Recon

Challenge	Mambo Mission/FPV	Bebop 2/Anafi
Drone Racing		
FPV Recon		
Package Delivery		
Auto Pilot		

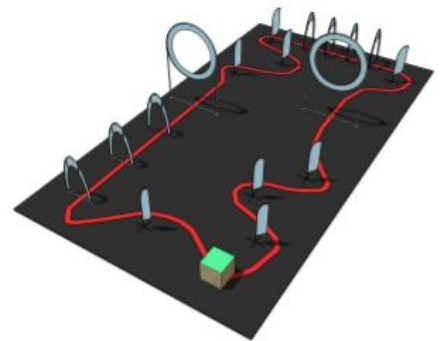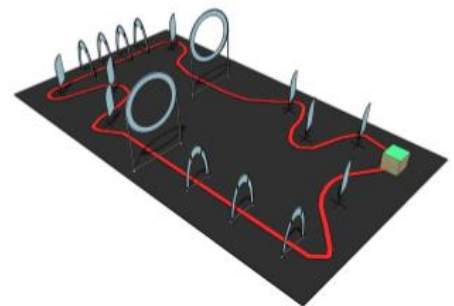# Drone Racing Challenge

The Challenge:
The challenge is played on a 24' x 40' field configured as seen to the right. Teams are tasked with flying their drone around the obstacle course. The object is to successfully navigate the course 3 times without hitting any of the obstacles.

The Field:
The 24' x 40' field contains a variety of obstacles through which the drone must navigate. This field contains two different kinds of obstacles. Teams must fly through the key hole gates and below the underpasses.

Drone Racing Challenge

Scoring:

The timer will start once the drone leaves the starting pad. The clock will run until the team completes 3 full laps and successfully lands back at the start/finish pad. Failure to navigate an obstacle will result in a 5-second penalty for each obstacle missed or hit. Any team not able to complete 3 laps within 5 minutes will be disqualified. The fastest time of the two attempts (plus any penalties) will be used at the Team's official flight time.
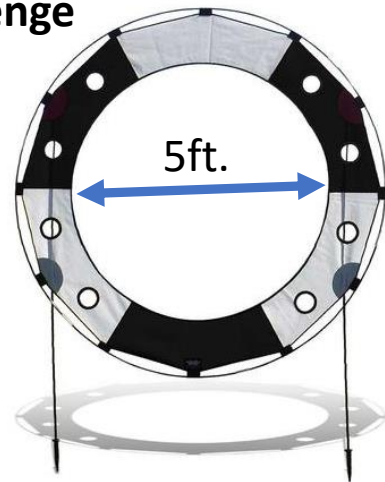
5ft.

The Round:

The competing drone will begin the round positioned completely inside the Start pad. Once the team is given the signal, the drone will begin navigating the course starting off with 3 Flag Poles. Coming out of the first set off Flagpoles teams will have to go through the first Elevated Ring and immediately followed by another Flag Pole. After the turn students will navigate into a series of 4 underpasses. Then there is another set of 3 Flagpoles followed by the last Elevated Ring which goes directly into another series of underpasses. The track ends with two more Flag Poles and then back to the start of the track. Time will stop once the team successfully lands on the Finish pad after their third lap.
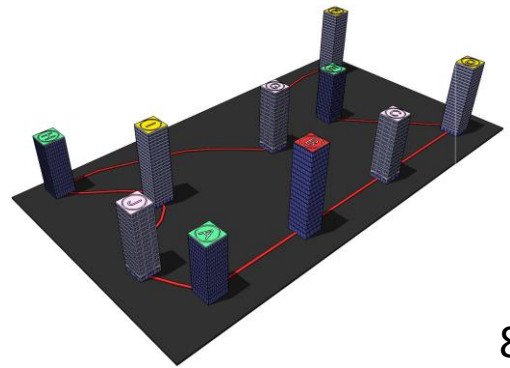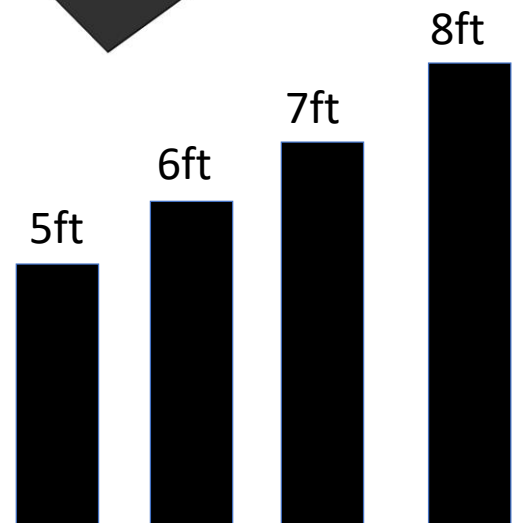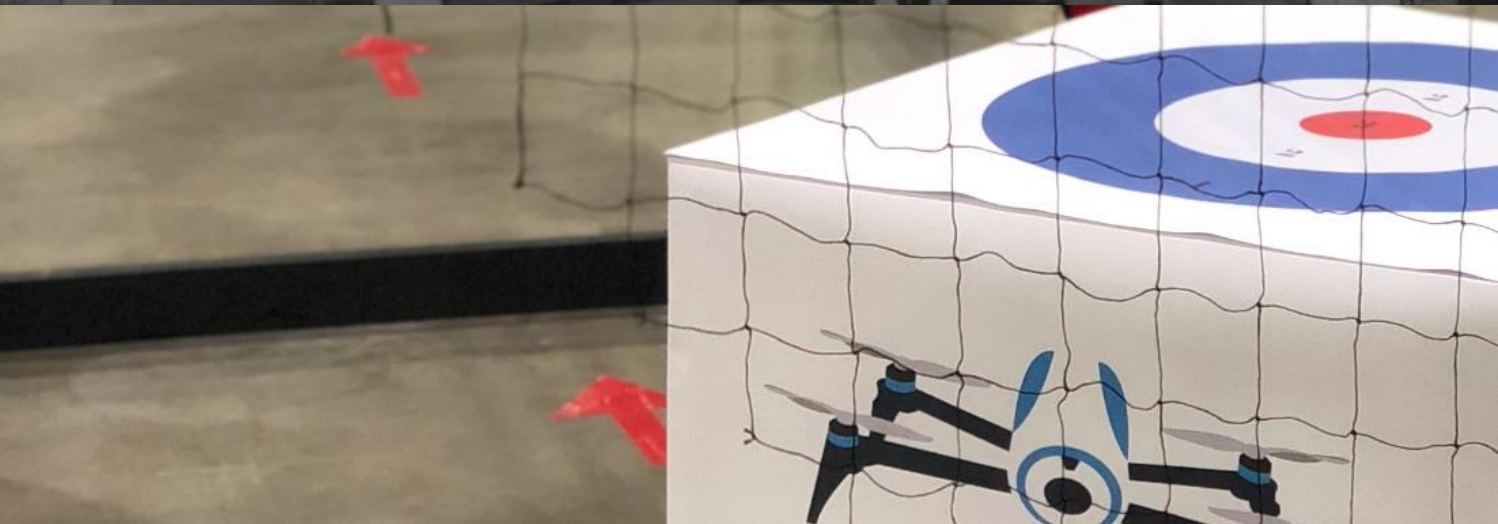
FPV Recon

The Challenge:

This challenge is played on a 24' x 40' field configured as seen to the right. Teams are tasked with using their FPV goggles to fly their drone around the obstacle course and locate 6-10 letters that are hidden within objects and using those letters to create a vocab word from the program. Words will change each round. The pilot will communicate the letters to his team who will then have to break the code.

The Field:

The 24' x 40' field contains a variety of obstacles and objects that can potentially have a letter written on or in them. The field will contain different objects such as boxes, trees, tunnels, buildings, etc. Teams will not be allowed to see the layout of the field until the day of the race. Letters will be written on white boards that are hidden throughout the course. Each team will have two attempts and the word will change each time.
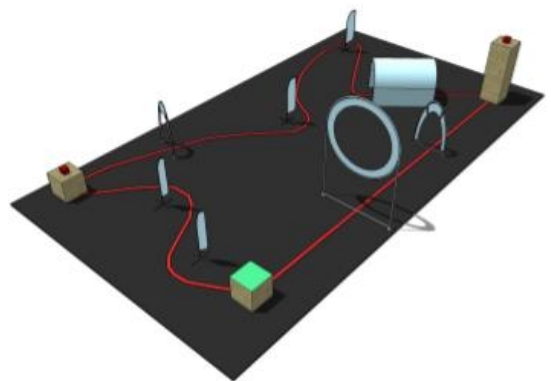

8ft

7ft

6ft

5ft

Package Delivery

The Challenge:

The challenge is played on a 24' by 40' field configured as seen to the right. Teams are tasked with flying their drone around the obstacle course. The object is to pick up a payload from the "Retrieval Tower" using a Team-designed retrieval mechanism, unload it at the "Delivery Point," as many times as possible in 5 minutes

The Field:

The Field contains a variety of obstacles through which the drone must navigate. The field contains a 3-ft tower from which the drone must retrieve a payload (weighing 50 grams). Once secured, the drone must continue to fly through the obstacle course with the payload, unload it at the "Delivery Point," which has multiple tiers of scoring per drop based on accuracy
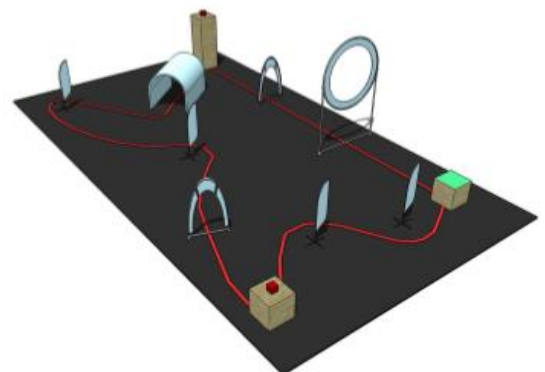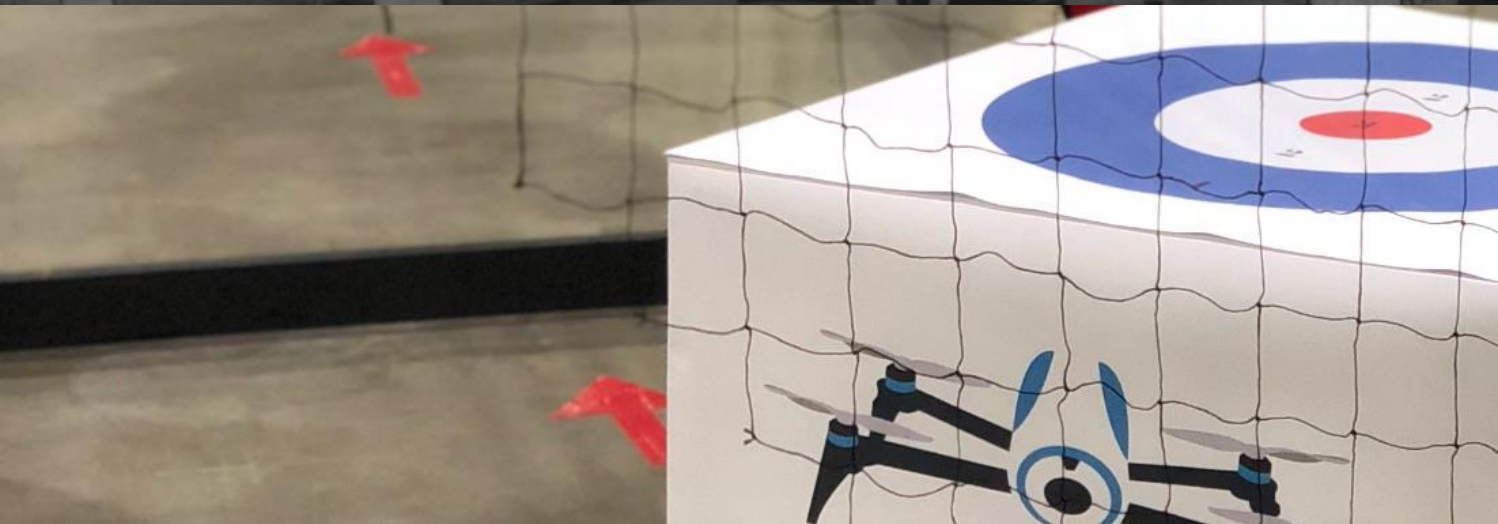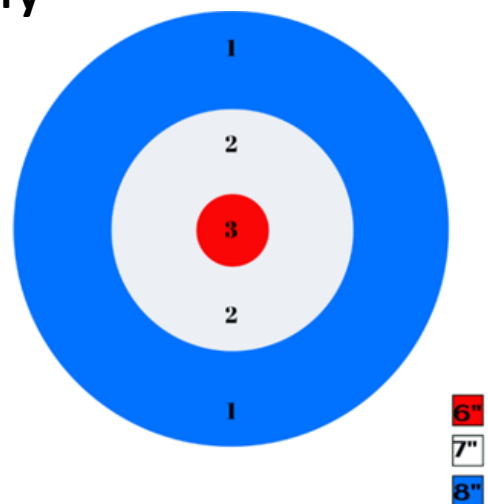
Package Delivery

Scoring:

This round will be scored by how many "payloads" each team can pickup and delivery within 5 minutes. Teams earn more points per drop based on their accuracy when unloading the payload. The center of the drop zone (3x3ft) counts as 3 points with the other remaining zones counting for 2 and 1 points.

6"
7"
8"

The Round:

The competing drone will begin the round positioned completely inside the "Start" pad. Once the Team is given the signal, the drone will begin by navigating the "Overpass" and "Underpass" to reach the "Retrieval Tower." From the tower, the drone must retrieve the payload using a Team-designed retrieval mechanism. The drone then must deliver the payload to the "Delivery Point" . Once successfully delivered, the drone must navigate the course again to pick up the next payload and delivery. This process continues as many times as possible within 5 minutes. Tie breaker for this round time which is marked by the time of the last delivery.

Auto Pilot

The Challenge:

The challenge is played on a 20' by 20' field which will be revealed on the day of the competition. Teams are provided with the distance between each obstacle at the start of the challenge. They are tasked with writing and developing a successful code to navigate the course successfully within 10 minutes

The Field:

The 20' x 20' field contains a variety of obstacles and objects that can teams will have to navigate through. There will be markings throughout the course which will indicate the distance between each obstacle. Teams will be provided with an overview of the course and distance between each object

Scoring:

This round will be scored by time. Once the team is provided the map of the course the clock will start. The team that gets from point A to point B in the fastest time wins. If no one completes the course the team that got the furthest within 10 minutes will win
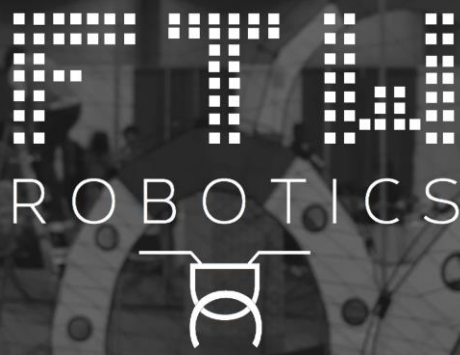
The Round:

The round starts with teams being provided a map of the course and distance between each point. The students will then have to build and develop a successful code that will get them from Point A to Point B. Teams are required to have a strong understanding of the Tynker CAD program prior to entering the competition

Special Project Instructions
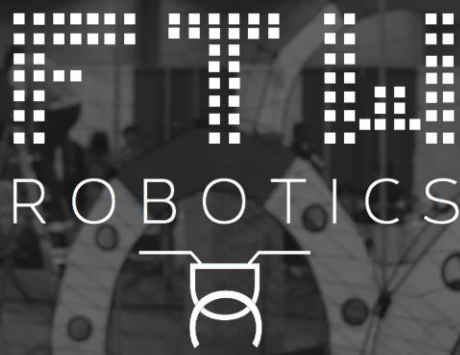
Initial Design
So that a successful drone flight and design can be replicated, this event requires that each stage of the design, fabrication, and programming process be well-documented. This requires that your Team provide a thorough description of the retrieval device assembly instructions. Your documentation should explain any part substitutions that were made, include successes and failures. After your drone and mechanism has been designed, programmed, assembled, and documented, your Team will test the drone in a simulation of the valley and village at the FTW Robotics Drone Competition event.

Project Guidelines

Specific Requirements
The Competition Committee has provided an outline of materials to begin your planning and manufacturing process. Your success on this project is based upon the following criteria:
- Teams will be given an objective by the Competition Committee. The goal is to be met by using a Basic FTW Robotics Drone Kit as the "base aircraft," so each Team must be a FTW Robotics customer. The design phase will provide opportunities for engineering and fine-tuning your drone for the competition flight.
- Teams can include an entire class in the build and design phase of the competition but the actual flight attempts may only be comprised of two members at a time.
- A Documentation (Engineering) Notebook is to be created and used by Team members to chronologically document their project for the competition. It should include pictures, detailed assembly instructions, design evolution with changes, problems encountered and solved, decisions made, and test results. All pages must be bound, numbered, and dated.
- The Team-designed "retrieval mechanism" can be any material of choice (aluminum, plastic, 3D-printed, etc.)
- During an oral presentation session, each Team will have 5 minutes to share their solution with a group of judges. The presentation may incorporate support materials such as posters, lab notebooks, a prototype, and/or PowerPoint presentation. All notebooks and documentation must be turned in to the judges following the oral presentation session. The materials will be returned following the competition.
- After Teams have completed the first competition round with their drone, a second round will be offered.
- At all times, Team members are required to adhere to safety standards, such as the use of prop guards and eye gear where appropriate.
- All Team members and advisors are required to attend a debriefing session after the competition has concluded.

Competition Rules

Below are the official rules and guidelines for the FTW Robotics Drone Competition. All Teams will be expected to adhere to these rules.
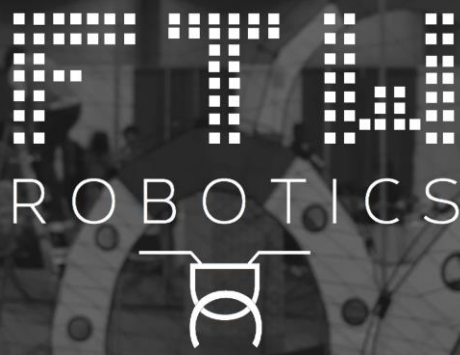
Definitions

- Pilot-Control Period: A 5-minute period in which drones are operated by no more than two Team members through the use of a wireless transmitter and receiver.
- Field Net: A safety net will surround the playing field. No one is allowed inside the Field Net while a flight attempt is occurring.
- Payload: The payload weighs 50 grams. It must be retrieved from the top of a 3-ft. tower and delivered to the "Delivery Point. The payload must be "dropped" within the pad's boundaries either directly on the "Delivery Point" or from no higher than 1 foot above it. If the payload is not upright or not touching any part of the "Delivery Point's" boundaries, the pilot may attempt to maneuver the payload.
- Design Judging Score: Judging based on Presentation Quality and Presentation Support Materials.
- Documentation Notebook: Judging worth Overall Appearance and Professionalism, Bill of Materials, Assembly Instructions, and Illustrations of Design Process
- Flight Time: A flight attempt is scored using the timing from "Start" to "Finish" plus any timing penalties incurred during the flight. Your flight time (in seconds) plus any penalties will be added and result in your total Flight Time.

Field Setup

- The Field is 24' x 40', enclosed by a net border
- Each competition field has a variety of obstacles through which the drone must maneuver including overpasses, underpasses, a tower, buildings and a tunnel
- Each course has a well-defined 24-inch rectangular Start/Finish pad.
- The Drone must begin fully within the "Start" pad
- For the Pack Delivery course the payload must be dropped off from no higher than 1 foot above the drop off point.
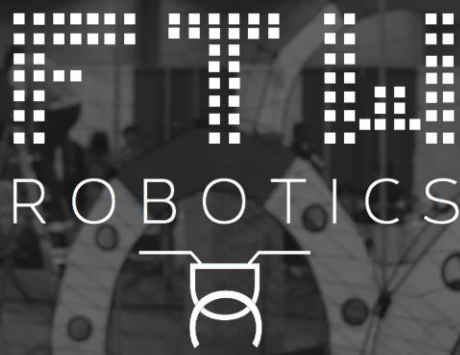
Flight Timing

- The timing of each attempt from take-off to landing will be used as the Team's base score
- Failure to successfully navigate an obstacle or touching an obstacle will count as a 5-second penalty for each incident
- There will be no timing penalty if a drone touches/lands on the ground as long as it is able to continue flight without intervention
- If a drone must be placed upright due to a crash during a flight attempt, timing will continue while a Competition Official enters the Field Net to make the correction
- If a team fails to successfully unload the upright payload within the "Delivery Point" Boundaries or fails to navigate the entire course within 5 minutes, the Team will receive a "0" for that attempt
- The Fastest time of the two attempts (plus any penalties) will be used as the Team's official flight time

Match Sequence

Each team will have two (2) flight attempts on each course to successfully complete the mission. Each attempt will be timed from Start to Finish and penalties will be assessed to the timing if necessary. If the Team is unsuccessful in completing the course within 5 minutes, that particular flight attempt will receive a score of "0". The best timing result of the two attempts will serve as the Team's "Official Flight Time".

Competition Match Rules

- Each attempt will be five or ten minutes long and will feature only one drone at a time
- Any drone that needs to be up-righted during the flight attempt will be done so by a "Competition Official". Timing will be temporarily stopped and resumed during this procedure. The Pilot may continue through the course as long as the drone remains "Flyable" and doesn't exceed the 5-minute restriction
- During a round, drones are to be remotely controlled only by the pilots. If any Team member touches his or her Team's drone at any time during a round, the drone will be disabled and the Team disqualified from that round
- Flight times will be calculated at the end of the timing (or after 5 minutes) after the drone has successfully reached the "Finish". Team members at not to enter the field or touch the drone at the end of any attempt until event personnel gives permission
- Drones must start the attempt completely inside the rectangle designated as the "Start

Drone Rules

- The drone may be checked by the judges at any time during the competition if they feel that the drone is out of compliance with the competition specifications.
- Drones must be the size of the airframe supplied by the FTW Robotics Drone Kit.
- A different LiPo battery size may be used if the Team determines it will help their performance.
- Drones must utilize the parts found in the FTW Robotics Drone Kit as a "base aircraft."
- The Team is tasked with designing and attaching a retrieval mechanism to their drone for the purpose of retrieving and unloading the payload. This design phase must be well-documented. No publicly-available devices may be used for this purpose, including publicly-available 3D print files. The device must be Team-designed.
- The retrieval mechanism must be designed by the Team
- Longer landing gear may be designed or publicly-purchased to assist with clearance issues.
- No drone may have mechanisms that could potentially pose a safety hazard to Teams or spectators.
- All parts of the drone must remain attached to the drone for the duration of the attempt. Minor pieces that unintentionally become detached from the drone, or are the result of improper design/construction will not cause a point loss as long as the drone remains flight-worthy.
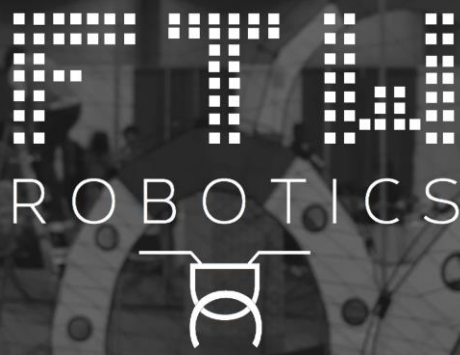
Field Malfunctions

IN THE CASE OF A FIELD FAILURE: The Team leader will communicate the problem to a representative of the Competition Committee. The representative will then discuss the problem with no less than two (2) additional Competition Committee members for a formal decision. If it is determined that it is in fact a field problem, the attempt will be replayed. In the case of a replayed attempt, the previous score will not be counted and the Team's new attempt score will count, regardless of whether the Team scores more or less points. If no field failure is determined the score for that attempt will stand as is.

Team Dynamics

The contest is designed to demonstrate the value of teamwork on a project. Teams should divide duties equally among all members; no individual should dominate. When necessary to achieve a particular outcome or goal, a Team member will assist their partner. All Team members are responsible for evaluating each other's work and contributing to the overall project's quality control.

Team Objectives

Each Team should work towards the following objectives:

- Construct a fully-operational drone that meets the requirements of the competition.
- Maintain a Notebook chronologically documenting the design evolution, materials used, and problems encountered & resolved, decisions made, and test results obtained.
- Be prepared to orally present the Team's final solution to the problem, incorporating support materials such as posters, lab notebooks, prototype drone, and/or PowerPoint presentation. Each Team may be represented by no more than 2 members for the presentation.
- Create a 2-3 minute video presentation with your Parrot Bebop drone that high lights your project along with current and future commercial uses of drones
- Demonstrate competent flight skills and the functionality of the retrieval device in competition.
- A successful project will require the use of critical thinking and problem solving abilities, self-management skills, professional writing skills, and clear oral communication.

Safety

Importance of Safety

It's in the best interest of all to maintain a safe work environment. Safety considerations will be taken into account during the FTW Robotics Drone Competition judging to assure a safe environment.

Safety Violations

If a Team or a Team member violates a safety rule, or operates their drone in an unsafe manner, the following penalties will be levied:

1st Violation: Team will be issued a written warning
2nd Violation: Team will have 15 seconds added to their overall time for that course and run
3rd Violation: Team will be disqualified

Safety Issues

- Team members must keep their work area reasonably clean. Clean work places promote efficient and safe working conditions. Special attention should be paid to keeping the floor clean and to the elimination of tripping hazards such as uncovered or dangling power cords in of walking aisles.
- Team members must keep their teammates and other Teams aware of possible dangerous situations, such as pinch points, sharp edges, tripping hazards (power cords) and tethered or wireless enabling of drones.
- Team members must wear safety glasses while they are in their work area.
- Tampering with or dismantling of any part of the supporting equipment (e.g., computers, printers, etc.) is a direct safety violation, and can be grounds for immediate disqualification.

EDU BUNDLES	
BASIC (FTW-001)	**PLUS (FTW-170)**
$1,199.99	$1,499.99
6) Mambo	(6) Mambo
(6) Battery	(6) Battery
(2) Controllers	(6) Controllers
(2) Battery + Charger	(2) Battery + Charger
(1) Hull	(1) Hull
(2) Propeller Sets	(2) Propeller Sets
(2) Motors (A + C)	(2) Motors (A + C)
(1) Multi Charger (Power Charger)	(1) Multi Charger (Power Charger)
(1) Tynker (30 Seats)	(1) Tynker (30 Seats)

with **Tynker**

INDIVIDUAL MINI-DRONE
FTW MAMBO (FTW-150)
$150.00
(1)   Mambo
(1)   Battery
(1)   Controller
(1) Battery + Charger

INDIVIDUAL DRONE

Parrot Anafi (FTW-201)

$699.99

- 1 Parrot Anafi Drone
- 1 Smart Battery
- 1 Parrot Skycontroller 3
- 1 Carry case
- 16 GB Micro-SD card
- 1 USB-A to USB-C cable
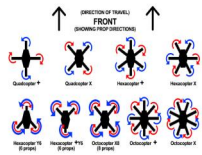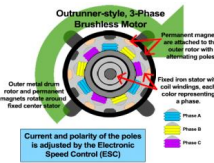- 8 Additional propeller blades
- 1 Mounting tool

with **Tynker**
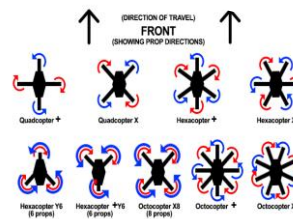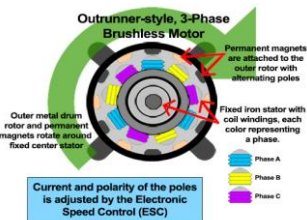
FTW 002 - Starter Classroom Set

FTW PLUS BUNDLE	1	$1,499.99
FTW Curriculum Access	Unlimited	$999.99
	Total	**$2,499.98**

with **Tynker**

x 2

FTW-003 - Advanced Classroom Set		
FTW PLUS BUNDLE	1	$1,499.99
FTW Curriculum Access	Unlimited	$999.99
Anafi	2	$1,399.98
	Total	**$3,899.96**
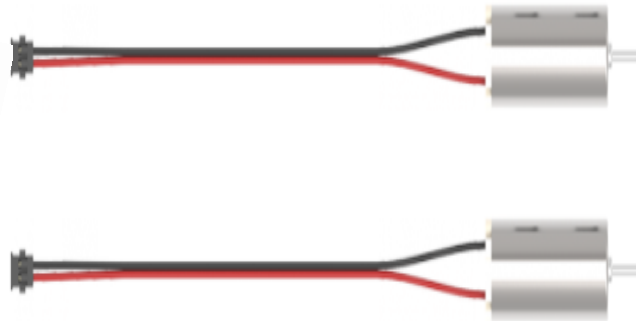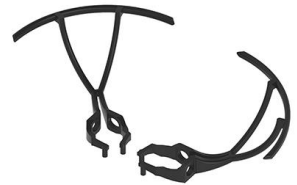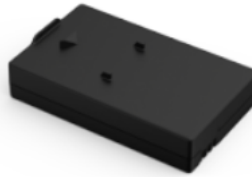
FTW-004 Spare Part Pack - $99.99	
Propellers (x4)	4
Spare Motors (Motor A+C)	2
Power Battery	1
Hulls (x2)	2
Battery Charger	1

Curriculum/Units

- 1: Design & Documentation
- 2: Safety Considerations
- 3: Introduction to Drones
- 4: Fundamentals of Flight
- 5: Airframes
- 6: Electric Motors
- 7: Propellers
- 8: Electronic Speed Controllers (ESCs)
- 9: Flight Controllers
- 10: Batteries, Charges & Connectors
- 11: Transmitters & Receivers
- 12: Cameras, Gimbals & Other Payloads
- 13: Ground Control Stations & FPV
- 14: Regulations & The FAA
- 15: Drone Maintenance & Battery Care
- 16: Efficiency vs. Performance

(DIRECTION OF TRAVEL)
FRONT
(SHOWING PROP DIRECTIONS)

Quadcopter +   Quadcopter X   Hexacopter +   Hexacopter X

Hexacopter Y6 (6 props)   Hexacopter +Y6 (6 props)   Octocopter X8 (8 props)   Octocopter +   Octocopter X
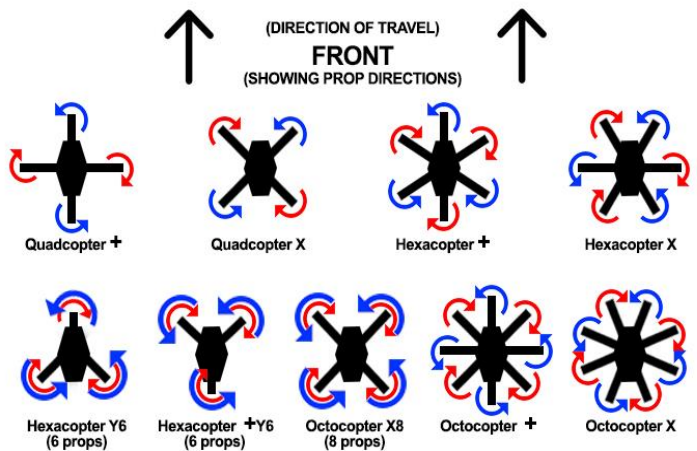
FTW Curriculum	FTW-007
Unlimited	$999.99

Case Studies

- We've developed a case study that allows students to explore each section of the curriculum and how it is applied in the real world
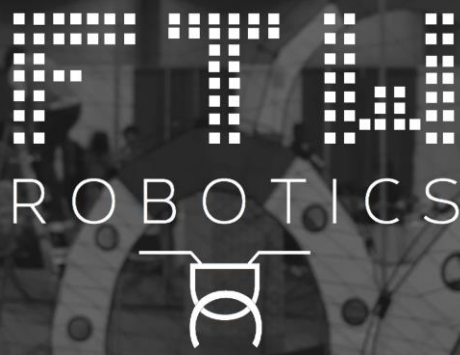
Quizzes

- Each Unit ends with a multi-question quiz where students answer a series of multiple choice, true/false, and write-in answers

Presentations

- Teacher materials available through online classroom or through a PPT presentation to give multiple options depending on your style of teaching

Curriculum/Units

- 1: Pathway to Certification
- 2: Drone Theory & Aeronautical Basics
- 3: Regulations & Operating Rules
- 4: Airspace Classifications & Operating Requirements
- 5: Aviation Weather, Effects & Sounds
- 6: sUAS Loading & Performance
- 7: Emergency Flight Procedures
- 8: Crew Resource Management (CRM)
- 9: Radio Communications
- 10: Airport Operations
- 11: Maintenance & Inspection Procedures
- 12: FAA Knowledge Test – Exam Prep

Each Unit Includes:

- Dedicated Handouts
- PowerPoint Presentations
- Vocabulary Definitions w/Quiz
- Student Activities
- Unit Quiz
- Teacher Lesson Plan

| Pilot Certification	FTW-008
Unlimited	$1,199.99

To qualify for a Remote Pilot Certificate, a person must:

- Demonstrate aeronautical knowledge by passing an initial Aeronautical Knowledge Test at an FAA-approved Knowledge Testing Center
- Be vetted by the Transportation Security Administration (TSA)
- Be at least 16 years old
- Read, write, speak and understand the English language (exceptions will be made for medical reasons, such as hearing impairment).
- Be in the physical and mental condition that would not interfere with the safe operation of a sUAS
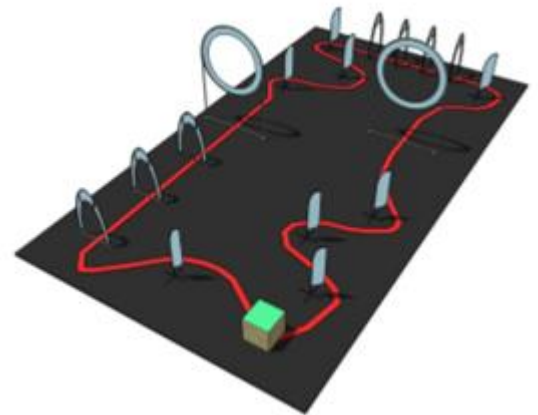
Package Delivery

Students must design and engineer a retrieval device which they can pick up and deliver packages to a drop point. Teams have 5 minutes to deliver as many packages as they can
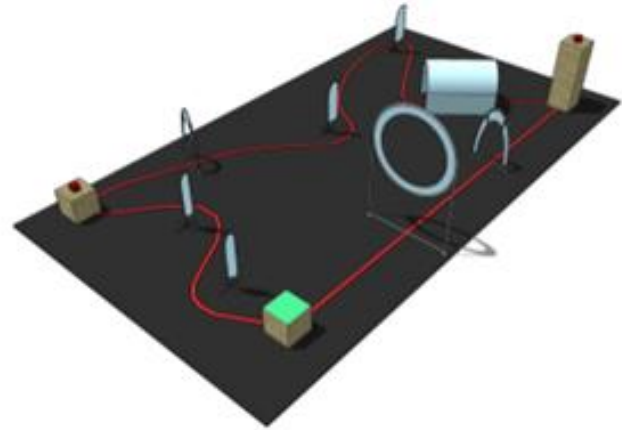
Drone Racing

Student test their piloting skills by navigating through an obstacle course and see who can complete two laps in the fastest time
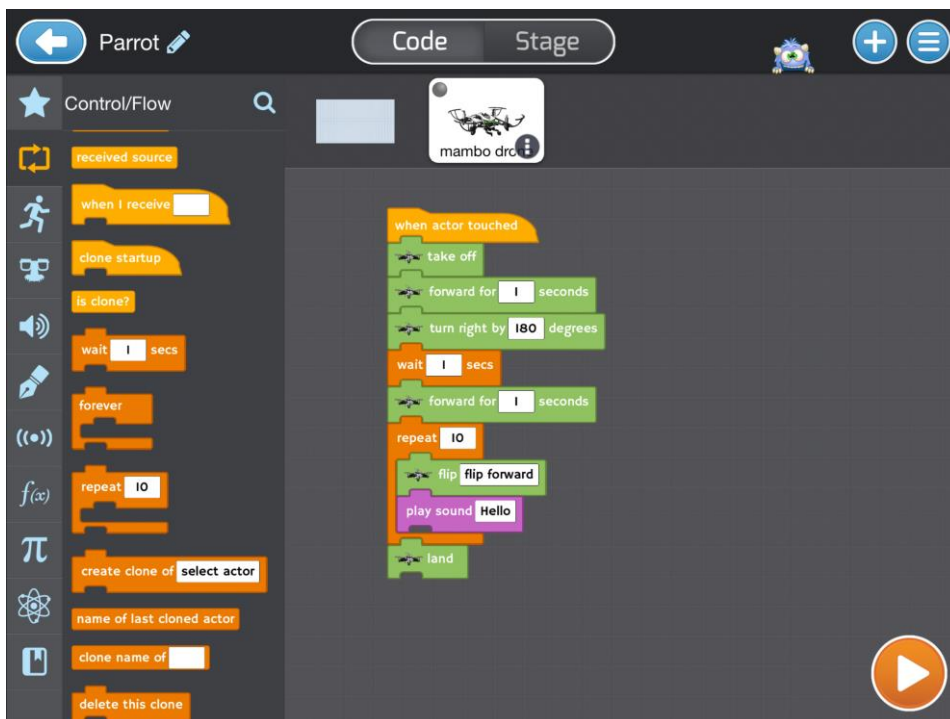
FPV Recon

Students use their FPV googles to search for hidden vocab letters on top of the buildings. Students must find all the letters hidden throughout the course and work together to determine which vocab word it spells.
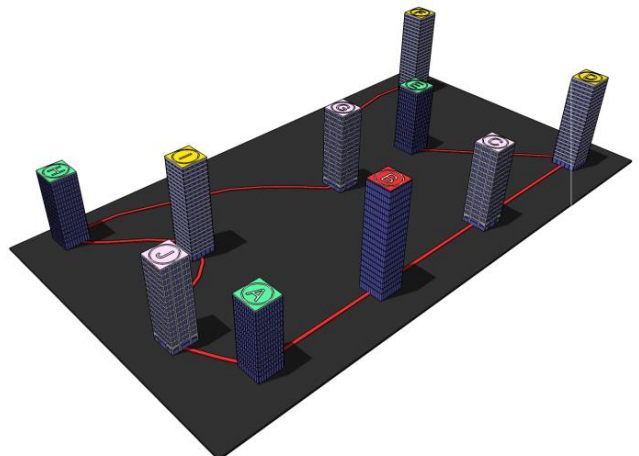
Auto Pilot Challenge

Teams must write a successful program their drone to get from point A to point B within 10 minutes

- Teams provided with distance between obstacles at the start of the challenge
- Students must know the calculations of distance and time prior to coming to the competition
- If no one navigates the course entirely, the team who got the furthest distance wins

PRACTICE & COMPETITION FIELD	
Practice Field (FTW-115)	Competition Field (FTW-009)
$599.99	$1,299.99
6 Arch gates	12 Arch Gates
2 Keyhole Gates	4 Keyhole Gates
	10 Telescopic Boxes
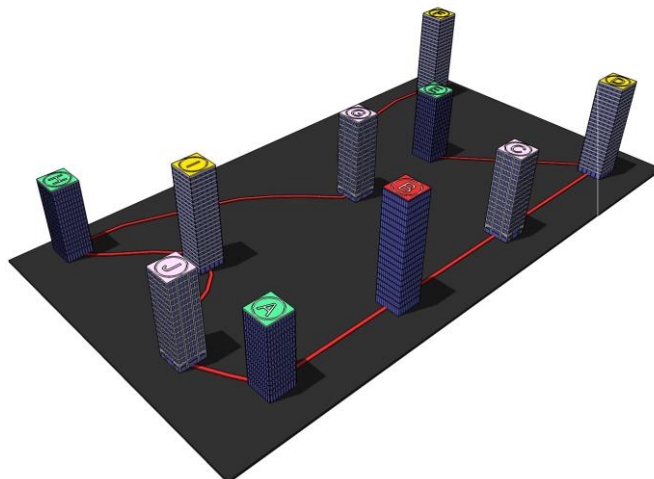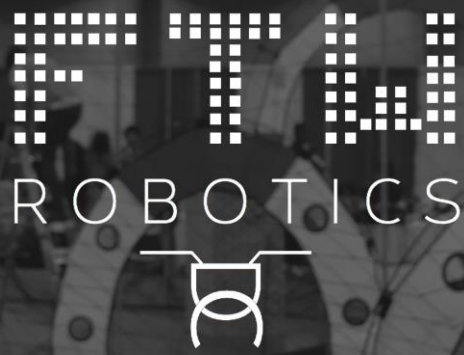
Contact Information

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