STUDENT ACTIVITY SAMPLES

EXPLORE OUR STUDENT ACTIVITIES

Grades K-3

LITTLE LEGENDS

Pages 1-16

Grades 4-8

STEM FUNDAMENTALS

Pages 17-34

Grades 8-12

FPV INITIATOR

Pages 35-50

Teacher Slides

Scavenger Hunt - Week Overview

Materials

Starter Kit Materials:	Story Theme Materials:	Printables Needed:	Materials not provided:
• 4 x Mission Mat • 4 x Little Legends Base Cards • 4 x Gimbal Character Playing Pieces • 1 pack of poly dots	• Scavenger Hunt Story • 4 x Legendale Neighborhood Game Cards (blue back) • 4 x Legendale Neighborhood Coding Cards (green back)	• Airplane Templates (several per student) • Activity Sheets (1 per student)	• Crayons, markers, or colored pencils

Scavenger Hunt - Week Overview

Daily Schedule

Day 1 (45 min)	Day 2 (45 min)	Day 3 (45 min)	Day 4 (45 min)	Day 5 (45 min)
Theme: Read	**Theme:** Explore	**Theme:** Code	**Theme:** Engineer	**Theme:** Design
Activity: **Read:** Scavenger Hunt **Physical Game:** Find the Clues	**Activity:** **Board Game:** Clue Connector	**Activity:** **Unplugged Coding Mission:** Scavenger Hunt	**Activity:** **STEM:** Paper Airplane	**Activity:** **Art:** Activity Pages Review and Repeat Any Activity

Step 4: Download the software & update your drones

Download the following 3 apps onto each of the Android or iOS devices you will be using.

Tello flight app: https://www.dji.com/downloads/djiapp/tello

Note: as of 9-1-2023, the Android version of the Tello flight app is not available on the Google Play Store. It must be downloaded and installed on your Android device using the link above or by scanning this QR code. Your IT department may need to approve the download. If you experience any issues email support@dronelegends.com. We're here to assist you.

Droneblocks coding app:

iOS (Mac - iPad) Google Play (Android)

Day 1 - READ

Overview

Lesson Duration: 45 minutes		
Story	Read Scavenger Hunt out loud	**10 min**
Physical Play	Play Find the Clues	**25 min**
Wrap Up	Clean up and discuss	**10 min**

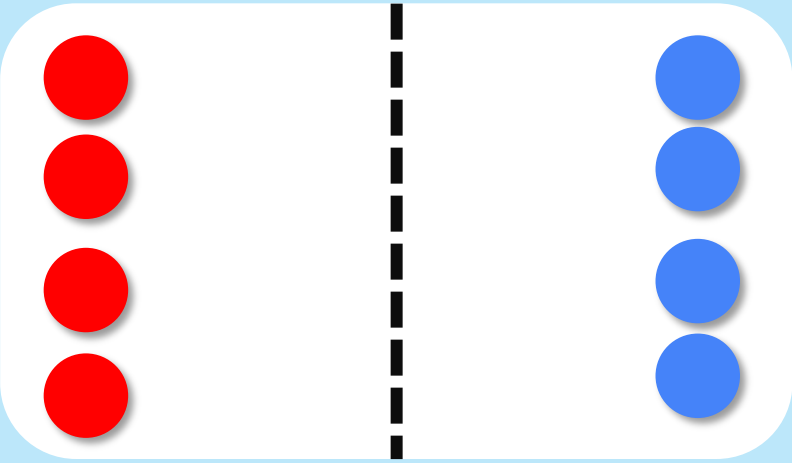
Day 1

Game Prep

Set-Up

Select 4 poly dots of the same color for Team one and 4 poly dots of another color for Team two. These will be their clues.

Mark the middle of the room. The unused colored poly dots, tape, or string can be used for this.



Game Play

Play like Capture the Flag: Similar to capture the flag, give each team time to hide 4 dots, or clues, on their side of the room. When the teacher calls go, the students try to race across the middle line to find the other team's clues. If they are on the other team's side of the line, that team can tag them, and they have to sit down until a person on their team tags them. If the player is holding a clue when they are tagged, they sit down with the clue. A player from their team can get the clue from them. The game continues until one of the teams finds all of the other team's clues.

Example: A player from Team 1 races to Team 2's side to find a clue hidden under a chair. The player gets tagged right before reaching the chair and has to sit down. Another player from Team 1 tags him and he runs to get the clue. As he is running back to his side, he gets tagged again and sits down with the clue. Another player from Team 1 goes and gets the clue from him and runs it back to their side.

Alternatives: If the tagging component is too much, just have each team hide the clues on their side and then each team tries to find all four hidden clues first. You could also make it so that the team members can only tag someone from the other team when they have a clue.

Welcome

Today we are going to read a story and then play a game called Find the Clues.

Day 1 - READ

Story

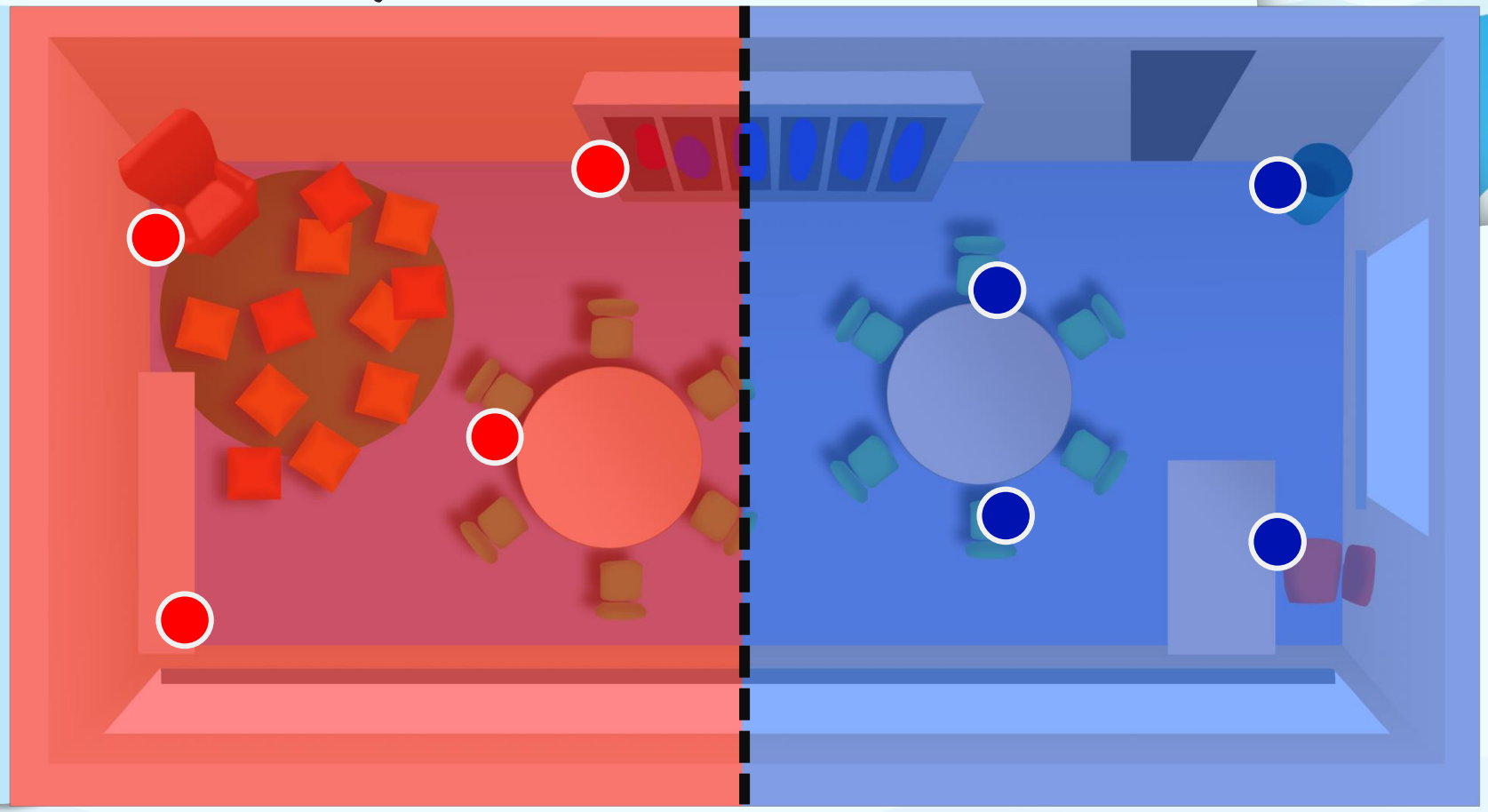
Have you ever had to take turns with someone?

How do you feel when you have to take turns?

Day 1 - Physical Play

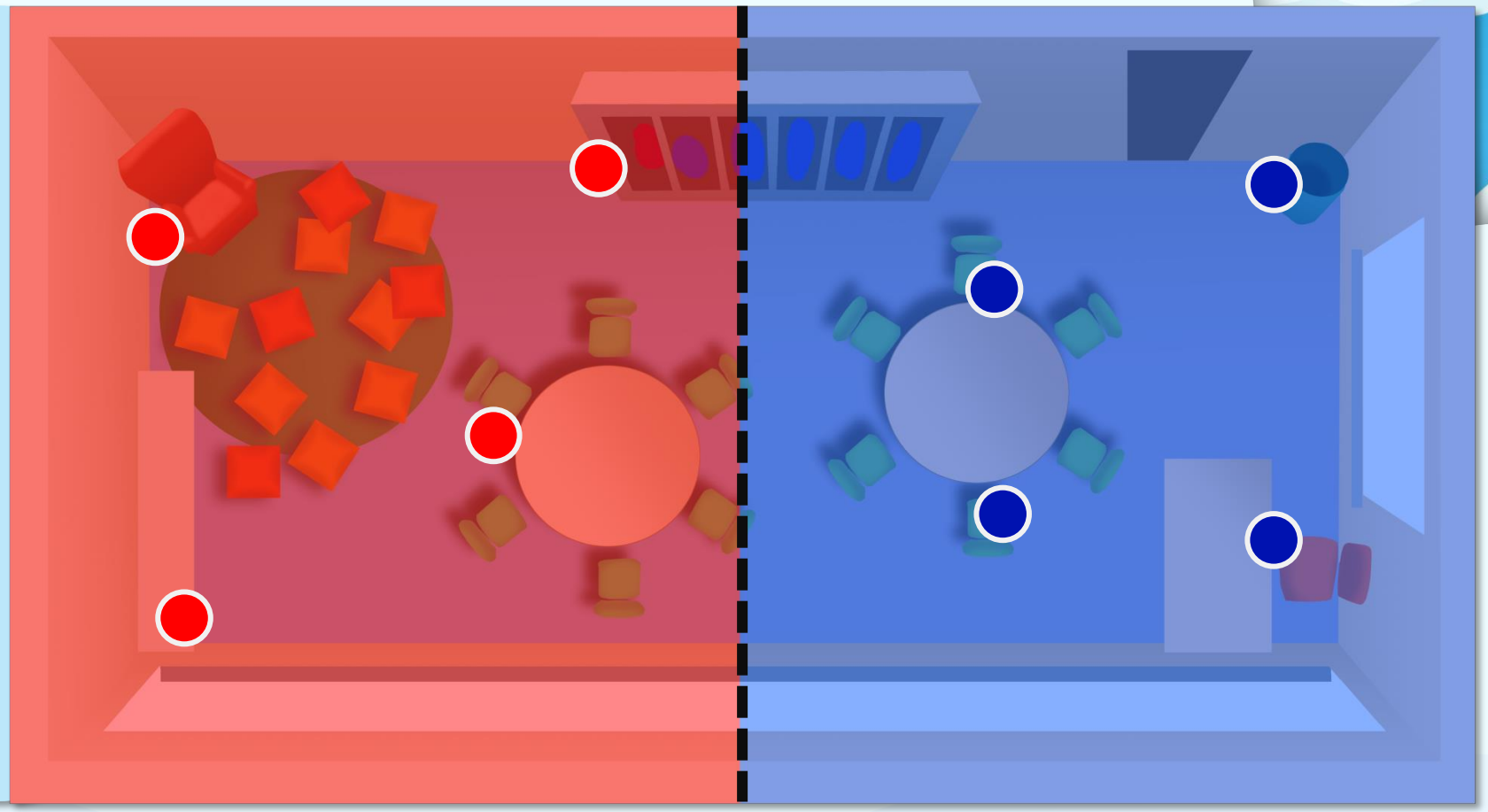
How to play Find the Clues...

Hide your clues on your side of the room.



Day 1

When I say, "Go," race to find the clues on your opponent's side of the room.



Day 1

If you get tagged...

Day 1

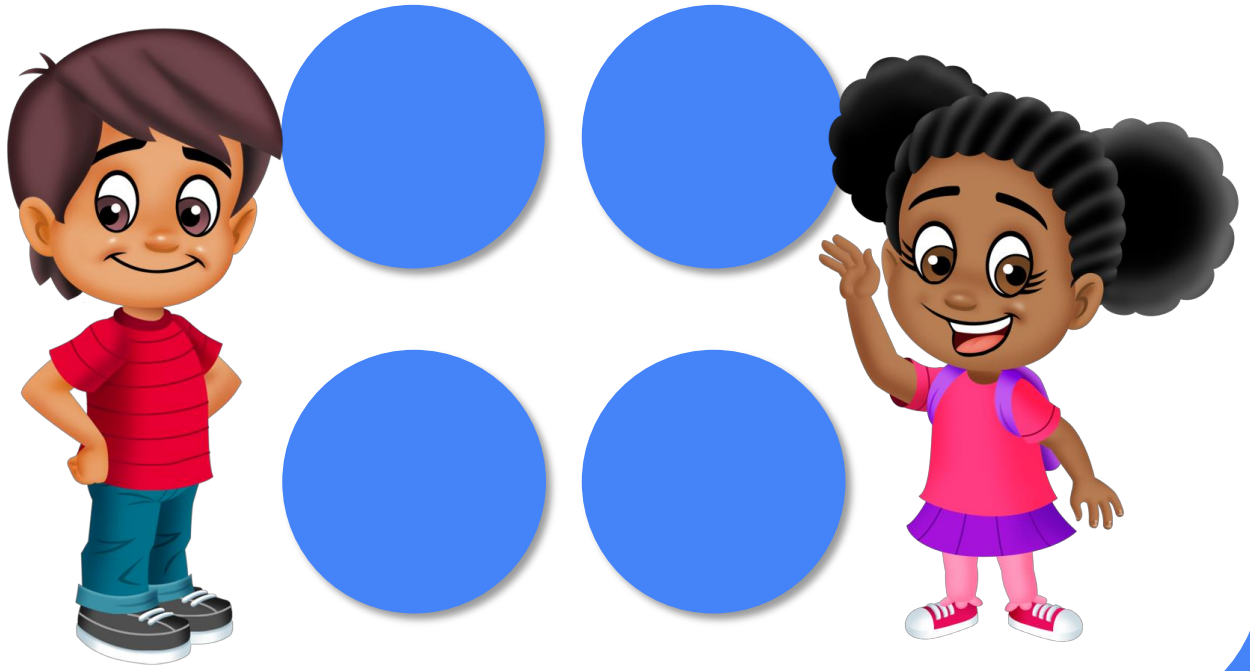
Sit down and wait for a teammate to come to you.

Day 1

Your teammate can tag you and set you free or take your clue back to your side.

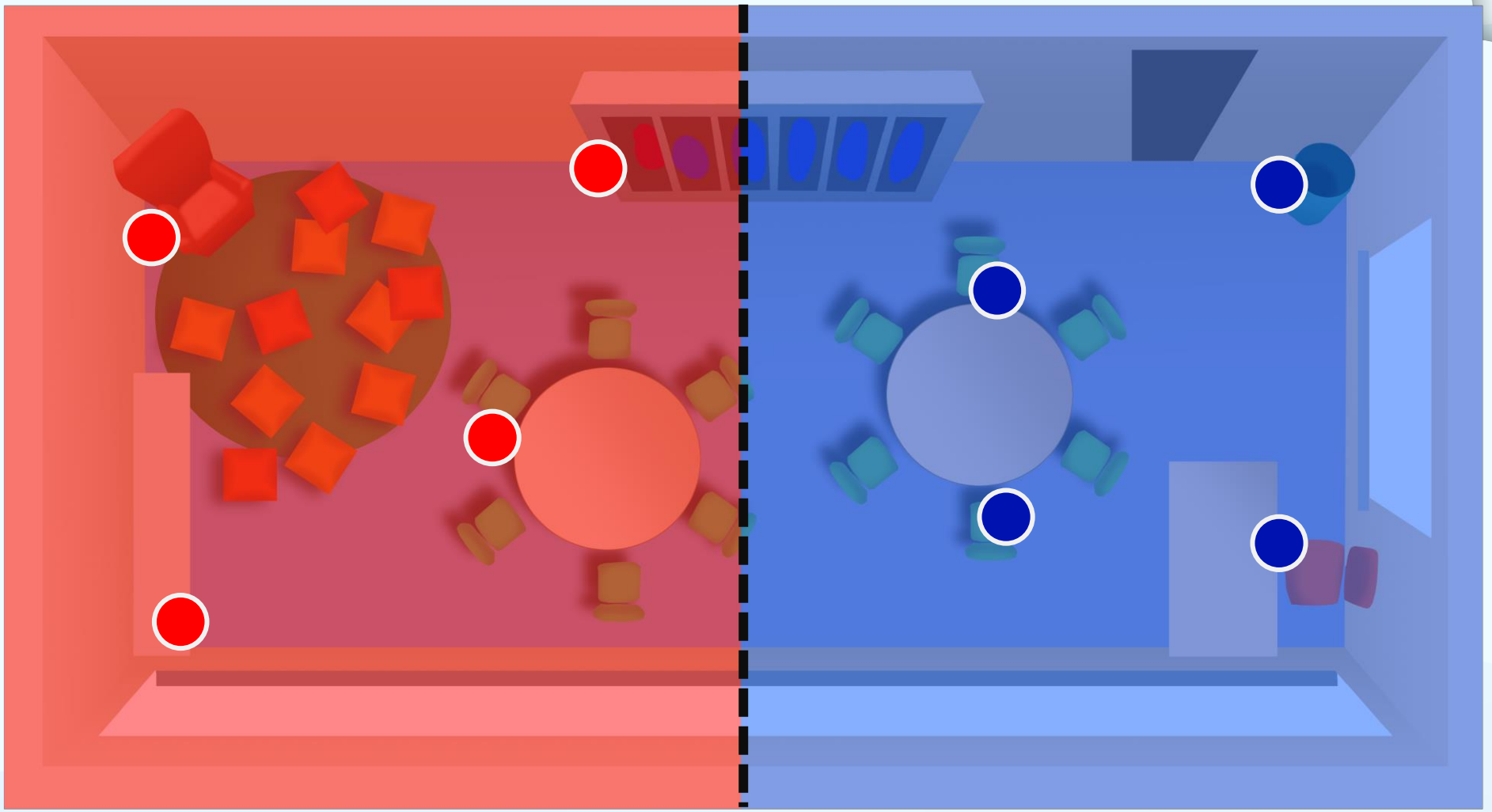
Day 1

The first team to gather all 4 clues of the opposite team wins.



Day 1

Lets play Find the Clues!



Day 1 - READ

Wrap up

What can you do to be legendary when taking turns?

FUNDAMENTALS

Mission Guide

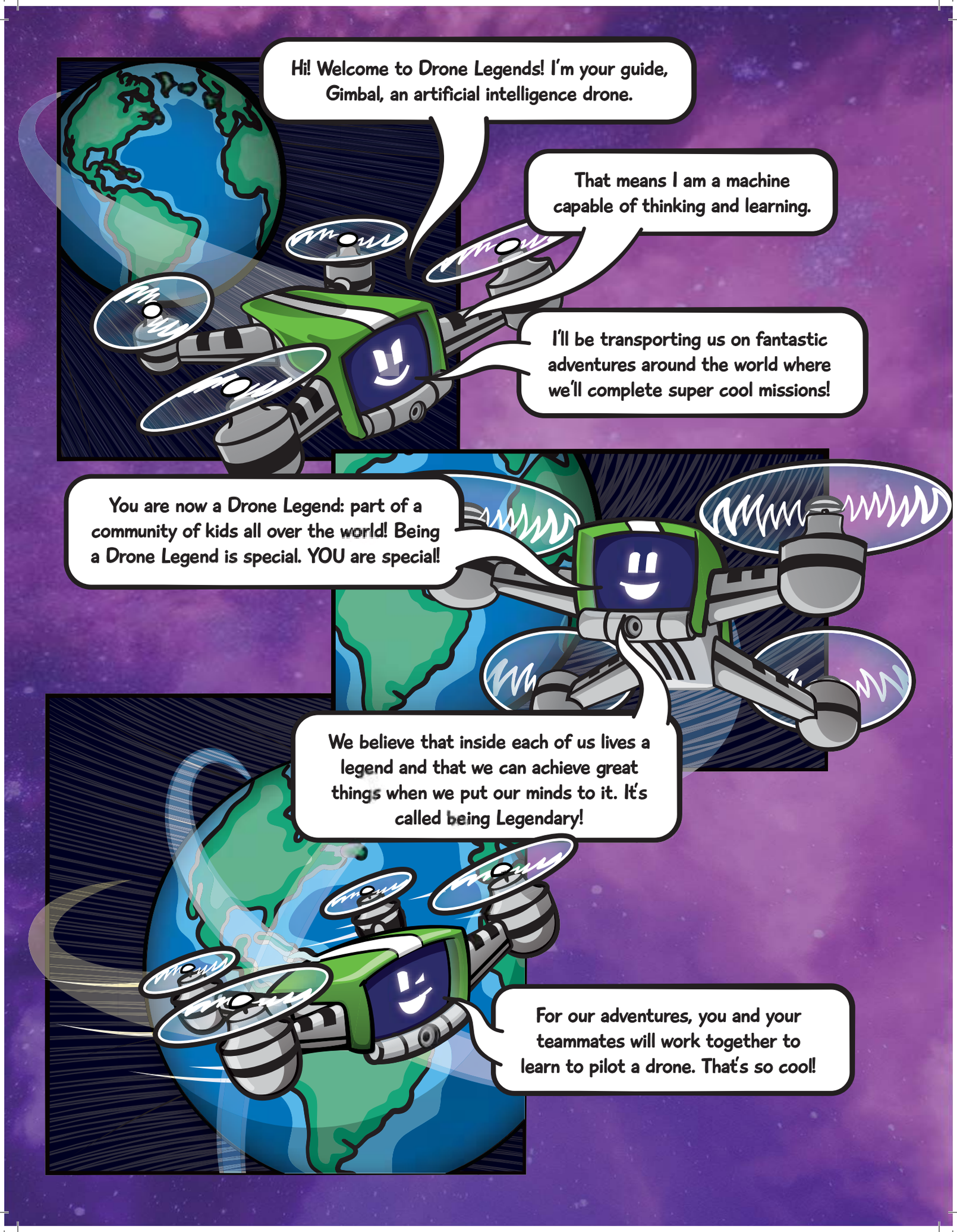
Drone Legends Fundamentals: Mission Guide

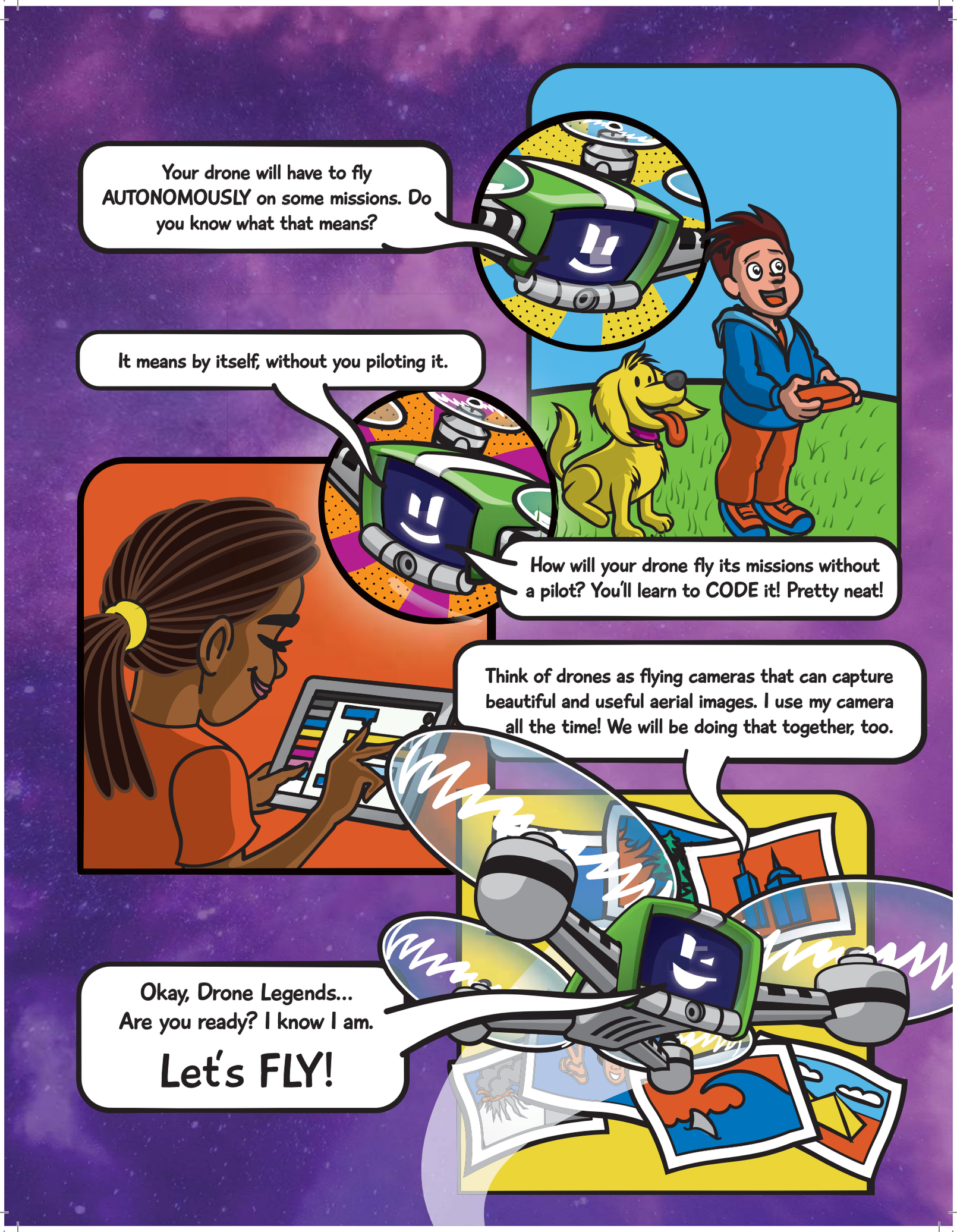
SECOND EDITION

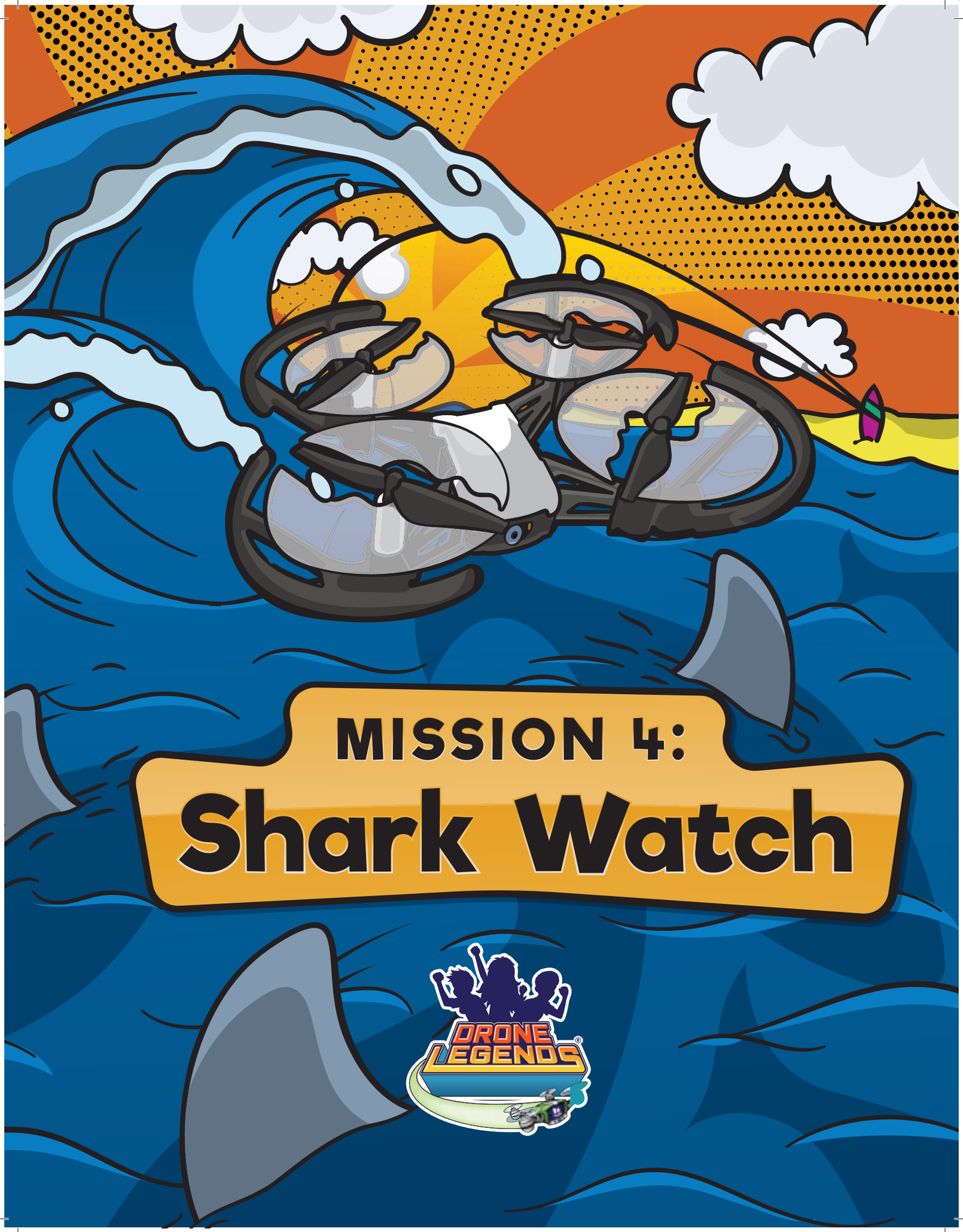
Copyright information

www.dronelegends.com

For more information:
info@dronelegends.com


Hi! Welcome to Drone Legends! I'm your guide, Gimbal, an artificial intelligence drone.
That means I am a machine capable of thinking and learning.
I'll be transporting us on fantastic adventures around the world where we'll complete super cool missions!
You are now a Drone Legend: part of a community of kids all over the world! Being a Drone Legend is special. YOU are special!
We believe that inside each of us lives a legend and that we can achieve great things when we put our minds to it. It's called being Legendary!
For our adventures, you and your teammates will work together to learn to pilot a drone. That's so cool!


Your drone will have to fly AUTONOMOUSLY on some missions. Do you know what that means?
It means by itself, without you piloting it.
How will your drone fly its missions without a pilot? You'll learn to CODE it! Pretty neat!
Think of drones as flying cameras that can capture beautiful and useful aerial images. I use my camera all the time! We will be doing that together, too.
Okay, Drone Legends... Are you ready? I know I am.
Let's FLY!

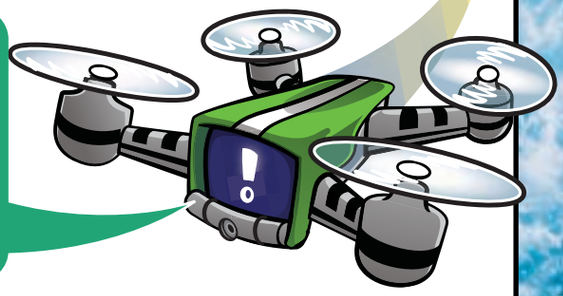


MISSION 4:
Shark Watch

DRONE LEGENDS®

Mission 4: Shark Watch

Sharks swimming along Maui's shoreline pose a risk to surfers, swimmers, and scuba divers. The Maui Coast Guard hopes you can use your drone to survey the shore and watch for sharks swimming near surfers. You will start by surveying the whole shore. When you spot a group of sharks, you will make Tello yaw 360 degrees as a signal to alert the Coast Guard.



Looking for sharks in a boat is ineffective because the boat is too close to the water to see the shark, covers space slowly, and disrupts swimmers. Helicopters are faster and have a better view, but they are expensive to operate and require a human pilot.

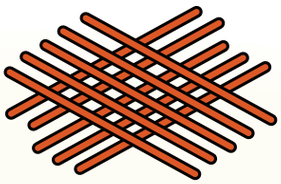
Drones are inexpensive and fast. They use artificial intelligence so they can spot a shark all by themselves. When they see a shark, they set off an alarm that alerts both the swimmer and the Coast Guard. The swimmer can swim away safely, and the Coast Guard can move the shark further offshore to keep the beach safe.

Maui's shark risk is at a dangerous level, and they hope you can help them find the sharks to move them further offshore.

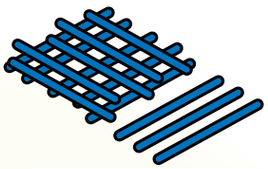
Build the coast

1. Collect 10 long poles, 13 short poles, 10 connector balls, a blue launch pad, and 5 sticky notes from the building station.

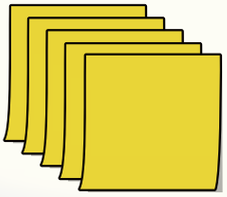
Launch pad X 1



Long poles X 10



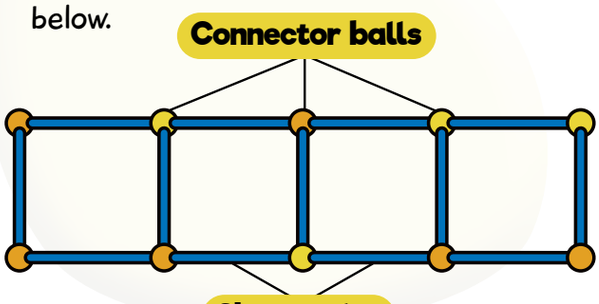
Short poles X 13



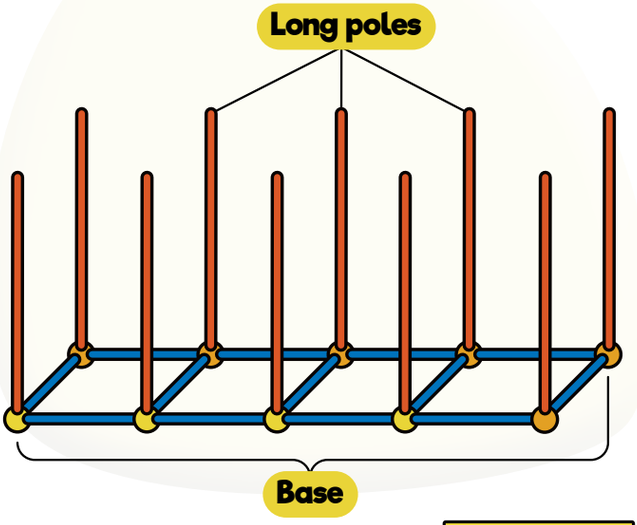
Sticky notes X 5

Connector balls X 10

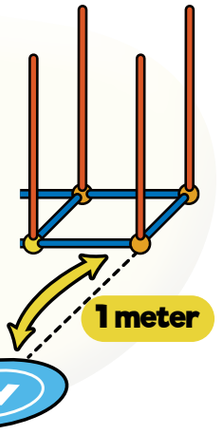
2. Build the base of your shoreline out of short poles and connector balls, as shown below.



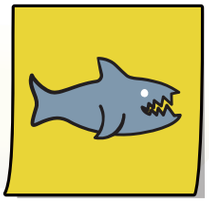
3. Add walls to your base using your 10 long poles, as shown in the diagram below.

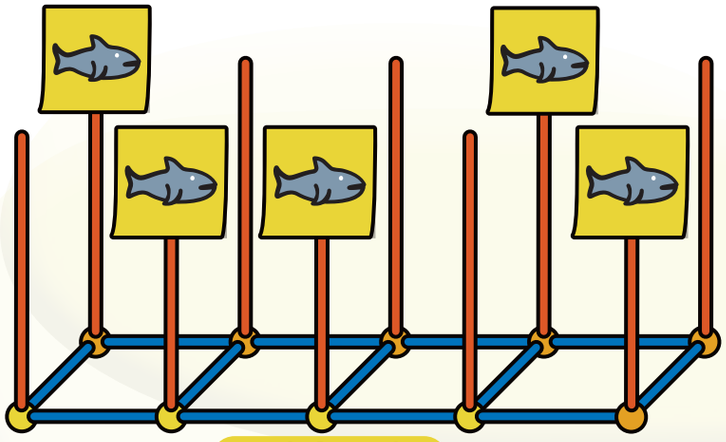


4. Place the Coast Guard watch station (launch pad) about 1 meter away from the shoreline. Line the center of the launch pad up with the right side of the shoreline.



5. Draw a shark on each of your sticky notes.

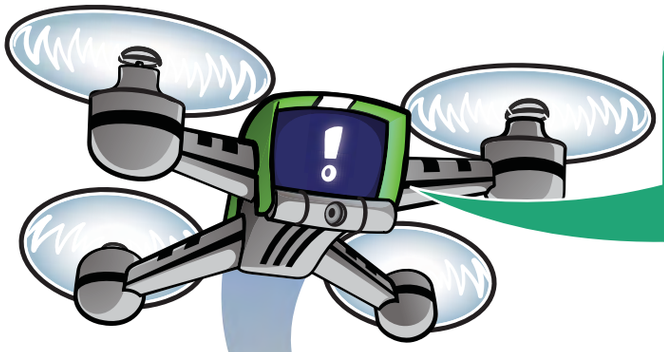




6. The Pilot will turn around and face away from the shoreline while the Safety and Observer place the 5 sharks anywhere on the shore. No peeking!

When the teacher calls start, the Pilot turns around and navigates to each shark. When the shark is visible in the camera feed, the makes Tello turn around by yawing 360 degrees in a circle.

That signals the Safety to run and grab the shark and move it farther offshore (return to stand next to the with the with the shark on the launch pad).



Tello and the should never be moving at the same time. Make sure Tello is hovering and motionless before the starts to move, and the should be back at the Coast Guard watch before Tello moves.

When your coastline is set up, get Tello, a battery, and a device. Assign the first roles for each team member.

Write down Tello's SSID in Box 1 of your Mission Notes.

Also. remember to tally the Pilot's points in Box 2 of your Mission Notes!

Time to Fly: Protect the Shore

Welcome to Maui. The Coast Guard has asked for your help in protecting the island's swimmers. Life-saving missions like these require integrity*. Thank you for choosing to do what is right so that the swimmers and the Coast Guard can all remain safe!

There are surfers and scuba divers in the water. You have 1 minute to collect as many sharks as you can before the swimmers are in danger of an attack.

01:00

Safety Role

Check Tello using the Safety Checklist. When you finish your check, insert a fresh battery, place Tello on the launch pad, and power on.

Give the a when Tello is ready to take off.

Safety checklist

Power button

*Integrity - doing the right thing even when no one is watching.

Stand next to the Pilot while they fly and watch Tello. Remember that you are acting as the Coast Guard. When Tello yaws 360 degrees, that is your signal! Check the camera feed to make sure you can see a shark, then grab the shark in front of Tello. Return and drop the shark onto the launch pad, then stand next to the .

At the end of the mission, remove the battery and put it into the used battery bin.

Observer Role

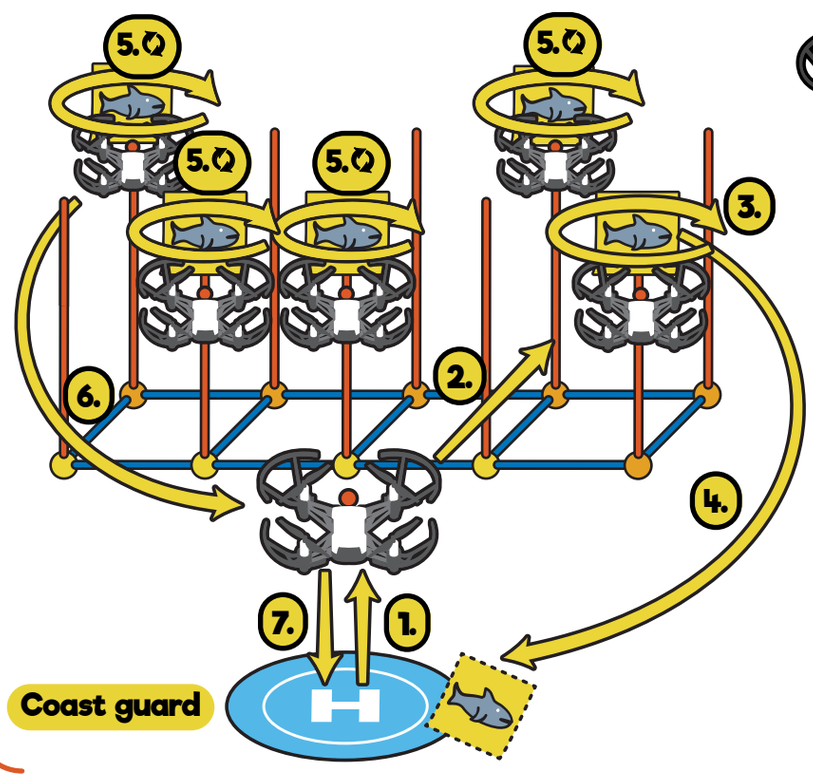
While the is flying, you will be walking alongside Tello and alerting the if they are close to anyone or anything.

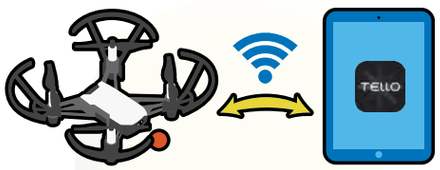
Alert the Safety when Tello stops to Yaw so they can remove and relocate the shark.

Alert the when the holds the shark further offshore (on the launch pad), so the can start moving again.

When the finishes their flight, help them navigate over the launch pad. Give them the to land when they are ready.

Pilot Role

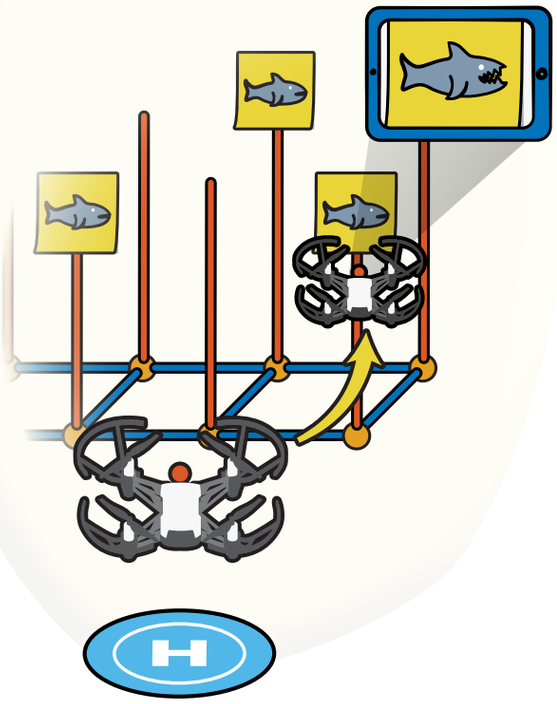


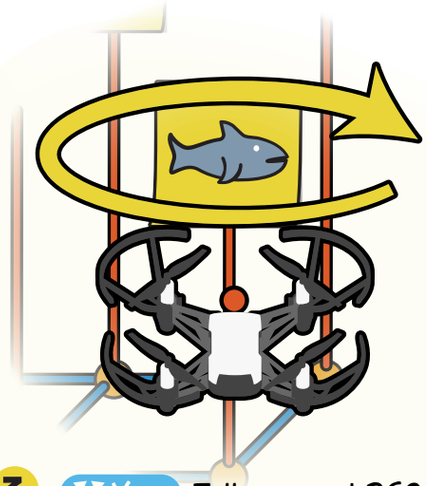


Connect Tello to the Tello app.

1. Wait for a from . Take off .

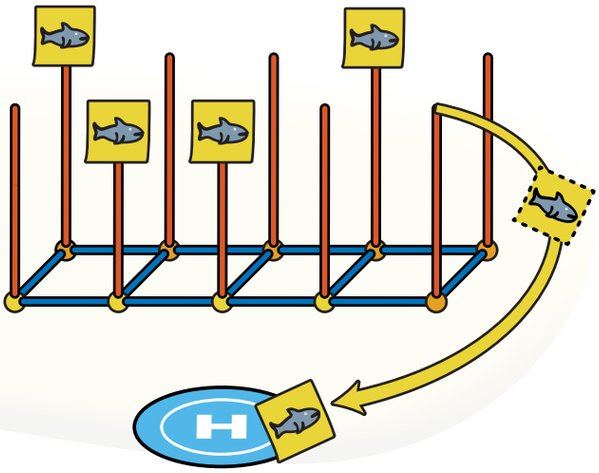
2. Maneuver to a shark so that the shark is visible in the camera feed.

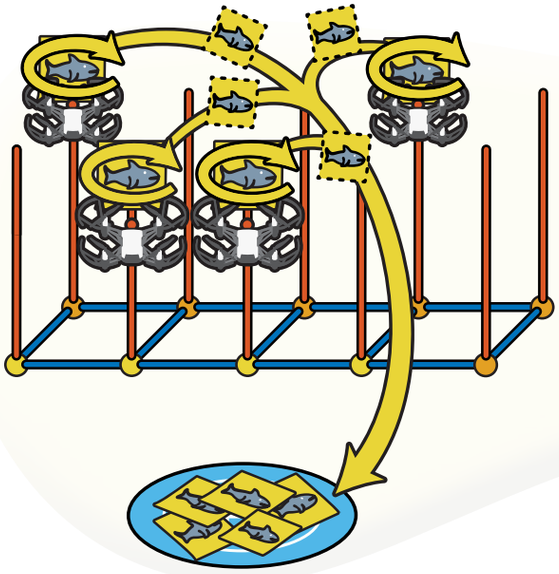




3. Yaw Tello around 360 degrees to alert the Coast Guard (Safety) that you see a shark.

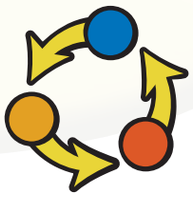
4. Once Tello is hovering but not moving in space, the can go collect that shark and move it further offshore (drop the sticky note onto the launch pad). Tello should not move again until the has dropped the shark.





5. Once the is standing next to the launch pad, the Pilot repeats steps 2-4, flying to the next shark and alerting the by yawing around and then hovering in its position.

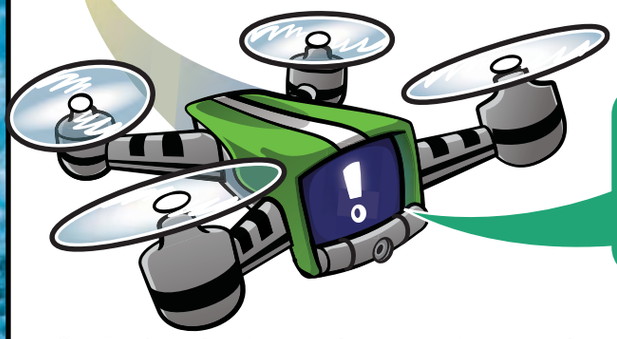
6. Navigate back to the Coast Guard watch station either when the teacher calls time or when all 5 sharks are found and relocated.
7. Wait for a 👍 from the Observer and tap to land.
8. Rotate roles and pass the control to the next Pilot.



When everyone in the group has had a turn in the role, return Tello to the docking station and meet at the Academy for a group discussion. While you wait, add your team's total points in Box 2 of your Mission Notes.

Time to Fly: Shoreline Watch

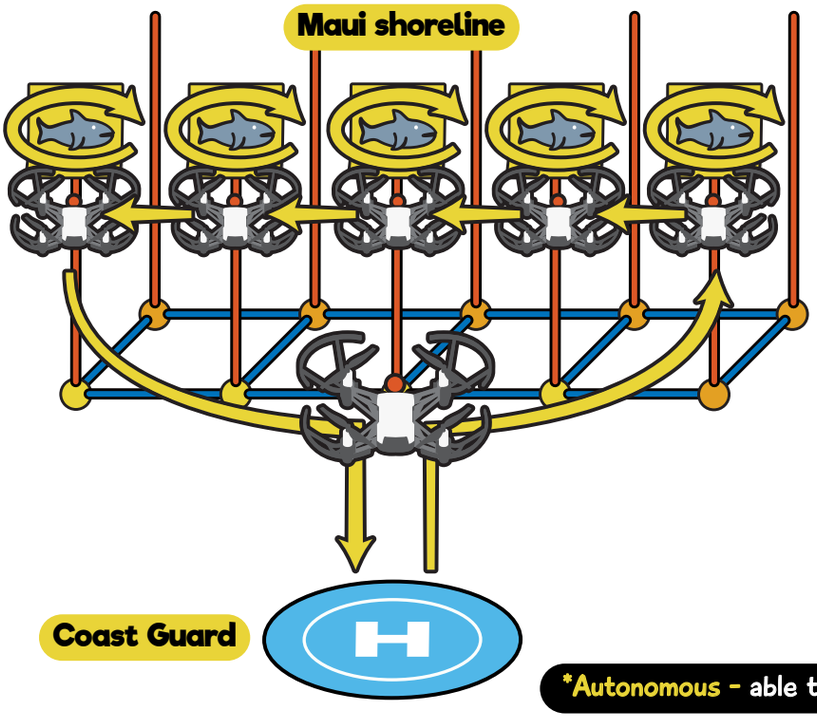
Answer the question in Box 3 of your Mission Notes.



Now you'll code an autonomous* mission to monitor the western stretch of Maui's shoreline. Your goal is to see how many sharks you can get to show up in Tello's camera feed as it flies its mission across the shore.

Stick the sharks to the coastline so that all **5 sharks are on the front poles facing toward you**.

You'll write your code so that tello starts at the Coast Guard station and flies forward until you can see the shoreline in the DroneBlocks camera feed.



Tello will then fly to each shark and yaw 360 degrees when it gets to each one. Tello should see each shark in the camera feed before it yaws.

The Coast Guard (Safety) can collect the sharks as they show up in Tello's camera feed.

*Autonomous - able to fly by itself without human piloting

Measure Takeoff Height

Before you can code a mission, you need to measure the DroneBlocks takeoff height.

This process is the same as the one you did in Mission 3: Finding Fumaroles. For step-by-step instructions, refer to Measure DroneBlocks Takeoff Height on page 17 of the Operations Manual.

Write down Tello's takeoff height in Box 4 of your Mission Notes.

When you finish measuring Tello's takeoff height, put Tello in the docking station until you are ready to launch your next mission.

Measure and Plan

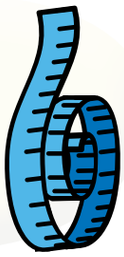
All team members will work together to measure and plan your coded mission.

Tello will be in the docking station during this portion of the mission until you check off your team's code on your completed Code Planner.

The Mission requires you to label the diagram in Box 5 of your Mission Notes!

1. Plan your mission using arrows ←→↓↑ on your Mission Notes. Label them 1., 2., 3., etc., to show where you will move first, second, third, etc.

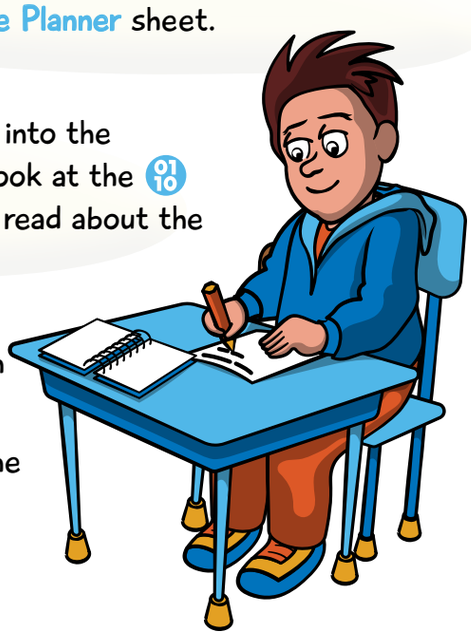
2. Take measurements for the distance between each shark. Label the arrows you drew in your diagram with the measured distances. Remember to measure in centimeters.



3. Working by yourself, write Tello's flight path on your Mission Notes as step-by-step directions, like those you might give to a friend.

4. Each team member should grab a blank Code Planner sheet.

Working by yourself, translate your written instructions above into the coding blocks you plan to use. Open the DroneBlocks app or look at the Coding Glossary on page 32 of the Operations Manual to read about the different blocks.



5. When you have your code written out, work together with your teammates and compare your code to theirs.

Discuss your code until you agree upon one code to use for the whole team. Write your team's code into a new column labeled Team's Code on your Code Planner sheet.

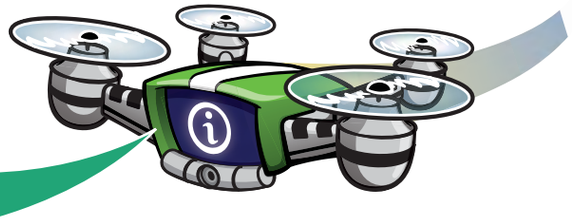
6. The pilot will build the code in the DroneBlocks app.

7. When you create the code, tap the ≡ Menu button in the app's upper right-hand corner. Tap Show Mission Code to see the Javascript code. View the code as a team.

Review the JavaScript code from top to bottom. Translate each block into JavaScript in the column next to your block code on your Code Planner. Here is an example of what one row of your Code Planner might look like.

Take off	takeOff();
Flip forward	flipForward();
Land	land();

Your code should match up with the JavaScript code. Knowing how to code with blocks uses the same logical skills as writing JavaScript code, just with less typing. If you finish this course and are ready to move on to text-based computer coding, you'll already have the logical skills you need. You'll just need to learn the proper language and type a bit more!



Tap the ≡ Menu button and Hide Mission Code.

8. Show your teacher your Code Planner and the matching code you built in the DroneBlocks app. If it is all satisfactory, your teacher will give you your Tello and you can fly your coded mission.

Fly the Code

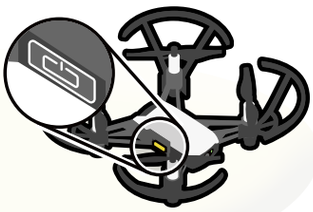
Read through all group roles before beginning the mission!

Safety Role

Check Tello using the Safety Checklist to make sure it is ready to fly. When you finish your check, place Tello on the launch pad and power on.

Give the Pilot a when all is ready.

Safety checklist



Power button

Grab the sharks as Tello moves past them if they were visible in Tello's camera feed. Put them further offshore (on the launch pad).

When the mission is complete, power down and remove the battery.

Observer Role

Check the code the Pilot builds in the app.

Walk with Tello as it flies the automated mission. Tell the to Abort Mission if Tello is flying off course or going to hit something.

Pilot Role

1. Wait for the Safety to check Tello and turn Tello on, then connect to the DroneBlocks app.
2. Once you are connected, click on the ≡ Menu button. Click on Launch Mission and watch as Tello completes your instructions.
3. If your measurements didn't work as well as planned, quickly revise your code in DroneBlocks. Rotate roles and run the mission again.

You don't need to revise your Code Planner sheet as you go. Just land Tello, rotate roles, let the new pilot edit your code in DroneBlocks, and launch your mission again. When your code is successful, write down the changes that you made next to your original code on your Code Planner sheet.

Gather at the Academy for a quick discussion about loops. While you wait, you can turn to page 19 of the Operations Manual and read about Loops.

Time to Code: Loop the Shore

Instead of scanning the shore once, rotating at each shark, the Coast Guard wants to know if you can scan the shore back and forth 10 times, rotating at each shark.

What will that mission code look like? Probably pretty long. Now imagine the Coast Guard asked you to scan back and forth 100 times? Pretty gnarly, right?

Computers are quite clever, though. Surely there is an easier way to write that code?

If the code repeats itself, you can put the repeating portion into a loop. A loop is a repeating machine. Turn to page 19 of the Operations Manual and read about Loops.

Now you can refactor* the Shoreline Watch flying mission you did before, but this time you can use a loop to simplify your previous code.

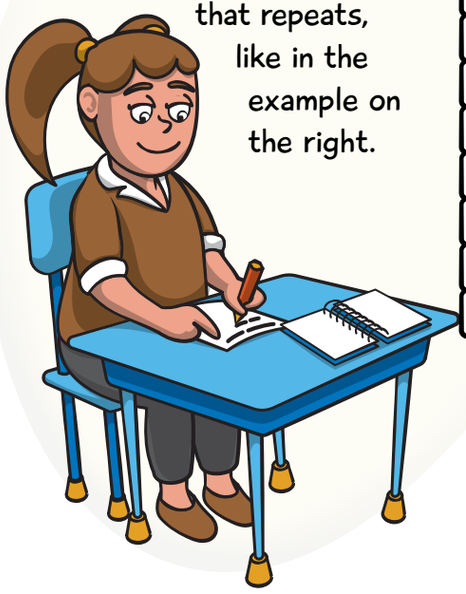
*Refactor - rewrite code to make it easier to read or use without changing the coded mission's goal. The code will still do the same thing, but the blocks will be different

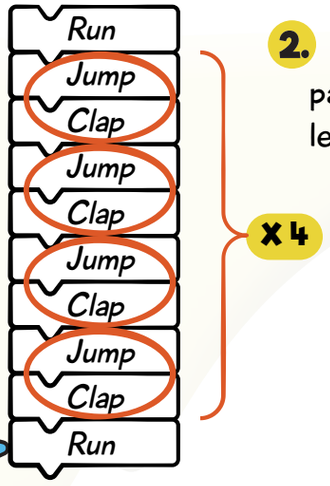
Refactor

Look at your final code from the (M) Shoreline Watch mission on your Code Planner. Work by yourself to do this refactoring.

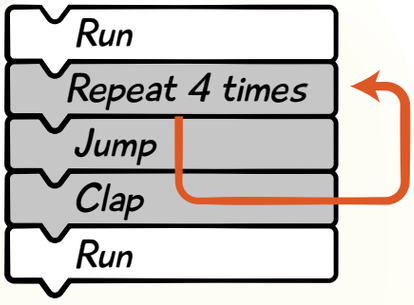
You might find refactoring a bit tricky at first. Try to stick with it. Just because it doesn't make sense right away doesn't mean you can't do it. With some effort, you can.

1. Look for a repeating pattern. Circle the portion of the code that repeats, like in the example on the right.





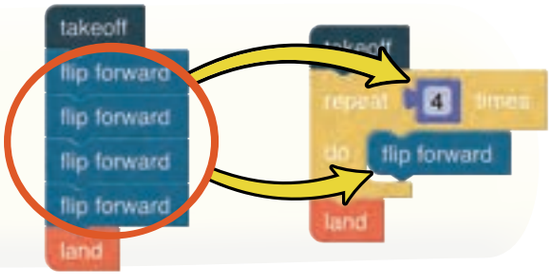
2. Count the number of times the pattern repeats, as shown here on the left.



3. Now write the repeating pattern inside the loop in a new column. Write out the number of times your loop repeats. Below the loop block, write the repeating pattern. Draw an arrow connecting the loop block to its repeating pattern, as shown above.

4. When you have your code written out, work together with your teammates and compare your refactored code to theirs.
Discuss your code until you agree upon one looped code to use for the whole team. Write your team's code into a new column labeled **"Team's Code"** on your Code Planner sheet.

5. The **Pilot** will build the code in the DroneBlocks app.



6. Show your teacher your Code Planner sheet and the matching code you built in the DroneBlocks app. If it is all satisfactory, your teacher will give you your Tello and you can fly your coded mission.

Read through all group roles before beginning the mission!

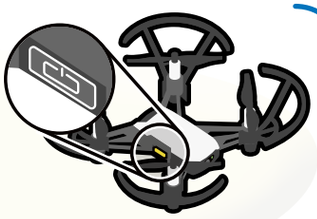
Fly the Code

Safety Role

Check Tello using the Safety Checklist to make sure it is ready to fly. When you finish your check, place Tello on the launch pad and power on.

Give the Pilot a when all is ready.

Safety checklist



Power button

Grab the sharks as Tello moves past them and puts them further offshore (on the launch pad).

When the mission is complete, power down Tello and remove the battery.

Observer Role

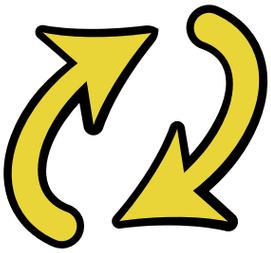
Check the code the builds in the app.

Walk with Tello as it flies the automated mission. Tell the to Abort Mission if Tello is flying off course or going to hit something.

Pilot Role

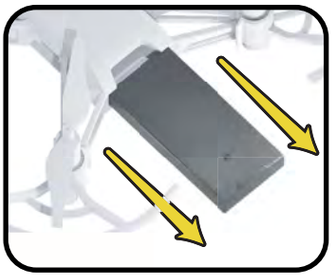
1. Wait for the Safety to check Tello and turn Tello on, then connect to the DroneBlocks app.
2. Once you are connected, click on the ≡ Menu button. Click on Launch Mission and watch as Tello completes your instructions.
3. If your measurements didn't work as well as planned, quickly revise your code in DroneBlocks. Rotate roles and run the mission again.

You don't need to revise your Code Planner sheet as you go. Just land Tello, rotate roles, let the new pilot edit your code in DroneBlocks, and launch your mission again. When your code is successful, write down the changes that you made next to your original code on your Code Planner sheet.

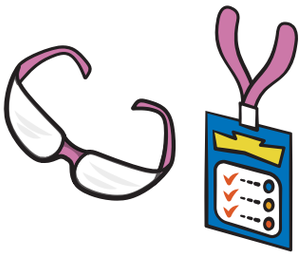


Wrap Up

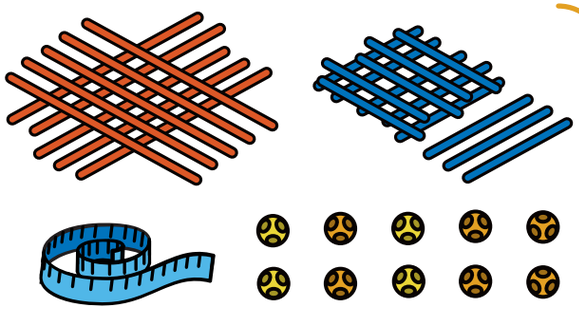
When your team successfully codes the Shoreline Watch mission, power down Tello.



The final Safety should pull out the battery and return it to the used battery bin.
The is also in charge of returning the safety goggles and Safety Checklists to the correct locations.

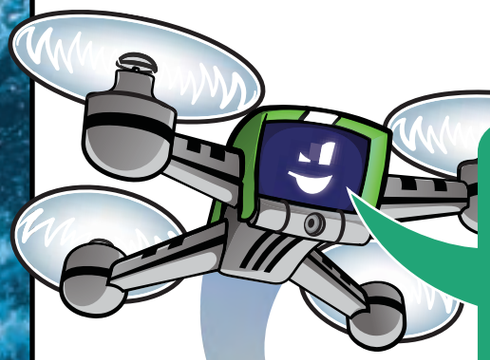


The final Observer is responsible for breaking down and returning the shoreline materials and measuring tapes to the correct locations.



The final Pilot should return the launch pads, Tello, and their device to their proper locations. The is also in charge of returning the team's Mission Guides and Operations Manual to their correct locations.

Your team can gather back at the Academy for a wrap-up discussion. Remember to take your pencils, clipboards, and Mission Notes with you.



I have one final task for you on this Mission: Answer the question in Box 7 of your Mission Notes.

Your expert piloting and coding skills have kept the surfers at Maui Shoreline safe! It's important to know that most sharks are not dangerous to humans — people are not part of their natural diet. Most attacks on humans occur when the shark is confused or curious. If a shark sees a human splashing in the water, it may try to investigate, leading to an accidental attack. That's why it is important to keep a safe distance and give them plenty of freedom to swim in their waters. Your early detection services with drones make that happen.

www.dronelegends.com

Precision Drone Piloting Program

FPV INITIATOR

PILOT HANDBOOK

Pilot Handbook

Table of Contents

Technical Support and Curriculum Questions

For technical support, please contact fpvtech@dronelegends.com
For curriculum questions, please contact fpvcurriculum@dronelegends.com

FPV Initiator Pilot Handbook

MODULE 1 - PILOT'S PRELUDE: MASTERING FPV DRONE BASICS AND GEAR INSIGHTS

Welcome to the FPV Initiator Program!

In this program, we will:

- Understand FPV drone piloting.
- Identify the materials and technical aspects required to fly and race drones in person and in a simulated environment.
- Understand real-world applications of drone technology and explore
- potential career pathways in the drone industry.
- Fly an FPV Micro Drone.

Module 1 Objectives:

- Understand the gear provided for drone racing.
- Work together as a racing team.
- Bind the Orqa FPV Controller to the Micro Drone.
- Link the Orqa FPV Goggles to the Micro Drone.

PRECISION DRONE PILOTING

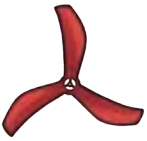
A precision drone pilot is a skilled professional who specializes in flying drones with precision and accuracy. They have a deep understanding of drone technology, aerodynamics, and flight principles and can apply this knowledge to operate drones in a precise and controlled manner.

Precision drone pilots work in various industries, including agriculture, surveying and mapping, cinematography, and search and rescue operations. They require strong hand-eye coordination, quick reflexes, and the ability to stay calm under pressure. Precision drone pilots must also possess excellent communication and collaboration skills, as they often work in teams with other professionals, such as surveyors, engineers, and photographers. With the increasing use of drones in various industries, precision drone pilots are in high demand, making this an exciting and lucrative career path for students interested in STEM fields and technology.

GEAR OVERVIEW

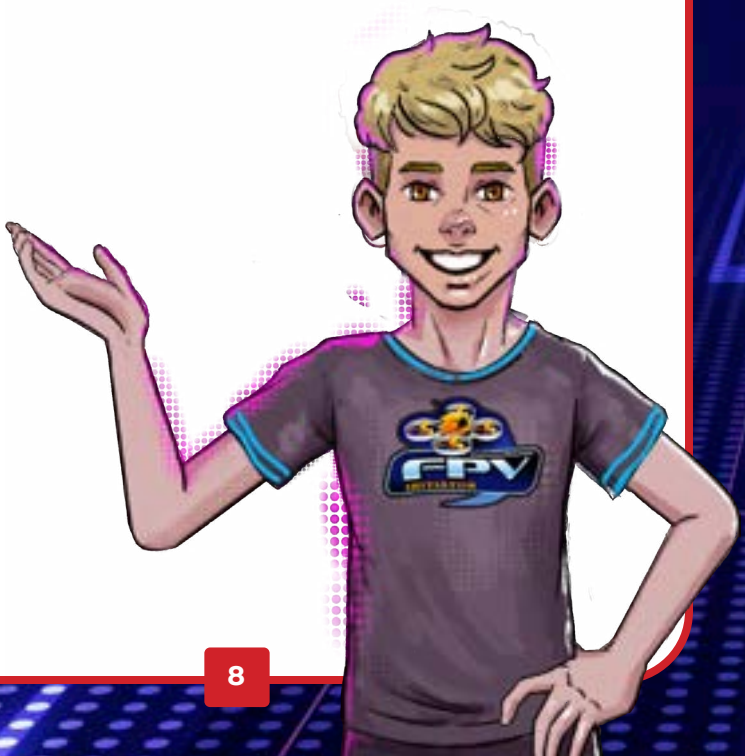
Goggles - Orqa FPV.OneRace	Controllers - Orqa FPV.Ctrl	Micro Drones - Orqa 65mm Micro Drone	ImmersionRC rapidFire 5.8Ghz Video Receiver
			

ImmersionRC Ghost UberLite Tx Module	Immersion RC SpiroNET v2 5.8GHz RHCP Diversity Bundle	1s300mAh Li-Po Batteries (packs of 4)	USB Goggle Battery Charger
			

Prop Sets (Pack of 4)	6 Port USB Flight Battery Charger	Security Trunk and Lock	4-Port USB Quick Charger
			

USB to USB Type C Cables	microSDHC 16B Card (pack of 3)	Li-Po storage bag	Type-C to Type-C for flight battery charger
			

1000 Ft. Measuring Wheel	Floor indicators (pack of 60)	Stopwatch (pack of 2)	Screw Driver
			



RACE TEAM ROLES AND RESPONSIBILITIES

Equipment Manager

The Equipment Manager maintains FPV equipment, enabling pilots to fly without technical worries. In teams, they ensure readiness and optimal function, aiding seamless flights and competition.

Pilot In Command (PIC)

The PIC's primary responsibility is the safety of the flight. This includes ensuring the drone works properly and evaluating potential issues before and during the flight.

Configurator

The FPV drone team's Configurator customizes drones for pilots, boosting performance. Continuous tuning maximizes individual potential, enhancing race competitiveness and team triumph

Spotter

The Spotter assists the PIC with other tasks, such as troubleshooting technical issues, making adjustments to the FPV goggles or equipment, and offering general support during the flight session.

BINDING: RADIO TO DRONE CONNECTION

You will need:

Orqa Micro Drone "Whoops"

Orqa FPV Controller

A smartphone or tablet with the FPV.Ctrl App

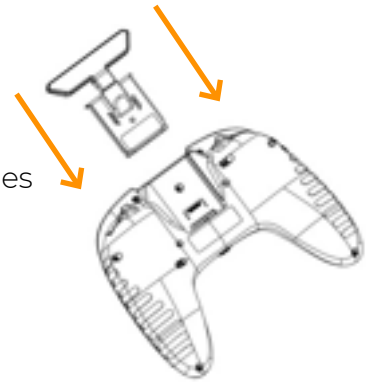
300mAH Lipo Battery

Orqa Controller Transmitter Module

BINDING: RADIO TO DRONE CONNECTION

STEP 1

Connect the Orqa Controller Transmitter Modules to the Orqa FPV Controller.



STEP 2

Power on the Orqa FPV Controller.

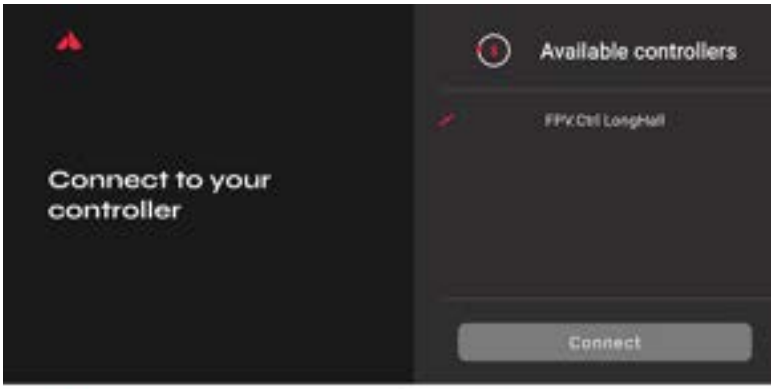
STEP 3

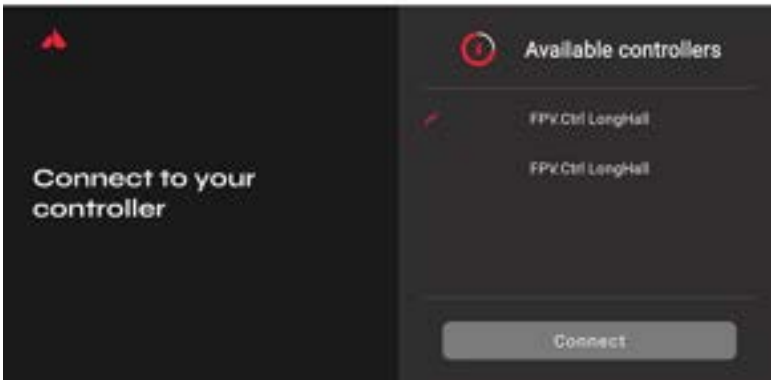
Open FPV.Ctrl App on a Tablet or Smartphone.

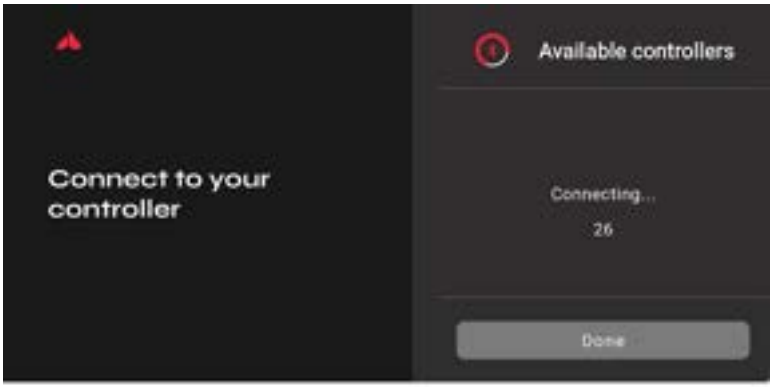
STEP 4

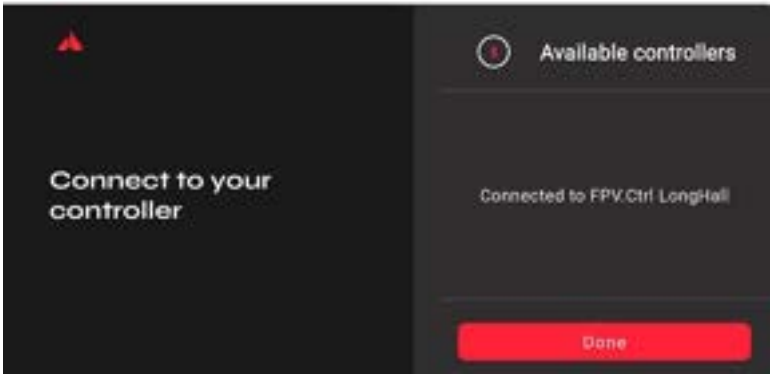
Connect the OrqaFPV Controller to the tablet via Bluetooth.

- To activate: Press and hold the “B” button on the Controller to turn on Bluetooth.







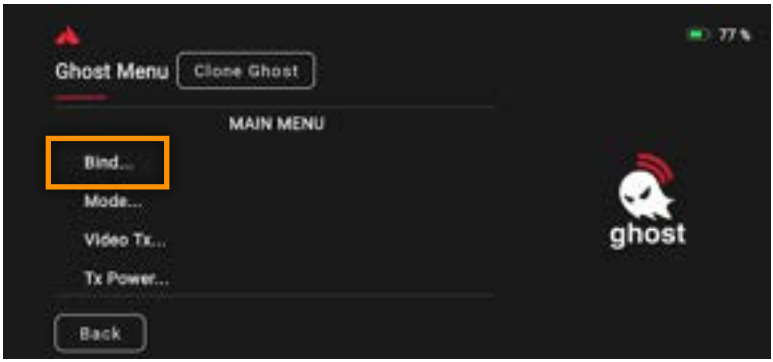


STEP 5

Open the Ghost menu settings.

STEP 6

Click “Bind” on the screen.



STEP 7

Click “Start Bind” on the screen.

STEP 8

Press and hold down the binding button on the inside rear of the drone using a small implement.

STEP 9

At the same time, while holding the binding button, power on the drone with the flight battery. (A second pair of hands is helpful here.)

STEP 10

Once bound, a green light on the back of the module and a green light on the drone will turn on.

Pro Tip: If lights are flashing or do not turn on, begin this process again.