Using Recreational Drones in STEM

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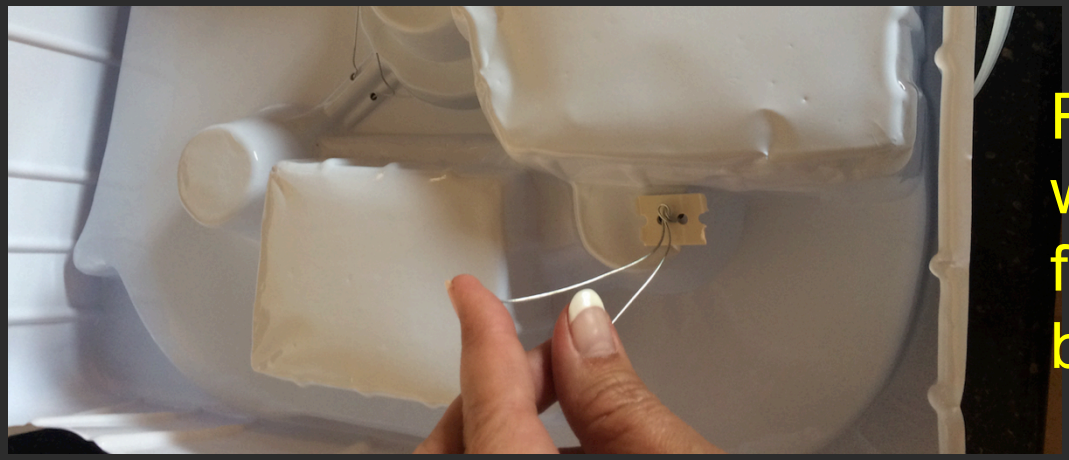
Earth Science Information Partners (ESIP) Education Committee

Unboxing your drone



Remove wires from back

Disentangle wires from legs without disturbing gears


Manual
Battery
USB Charger
Extra gears
Controller
Card & reader
Extra blades
Screwdriver
UPGRADE
U818A HD
2.4GHz
FUNC
SPEED

2nd battery is in the drone

Please do all you can to keep your stuff together!!

Tasks before we start Ground School

- ➔ Trade your signed release form for your boxed drone.
- ➔ Pick up 2 stickers, 4 dots, & 1 pen
- ➔ Head to your table to:
- ➔ Put your name on your box and manual. Save all packaging.

1. Put your initials on stickers / dot stickers
   - Your drone
   - Transmitter
   - Battery charger
   - Two batteries (different colors).

Safety & Civility first!

Follow the Golden Rule when choosing a location to fly.

Consider if you would (or could be concerned about seeing a drone in particular situations)

If the site of a drone is likely to disturb people or wildlife, don’t fly there.

Avoid wind.

Fly only in safe places: set and observe boundaries that keep you and your drone clear of traffic and other hazards.

Be alert! Don’t let enthusiasm overcome common sense.

Whenever you perceive potential dangers, stop and change the situation.

B4U Fly Smartphone App : FAA app

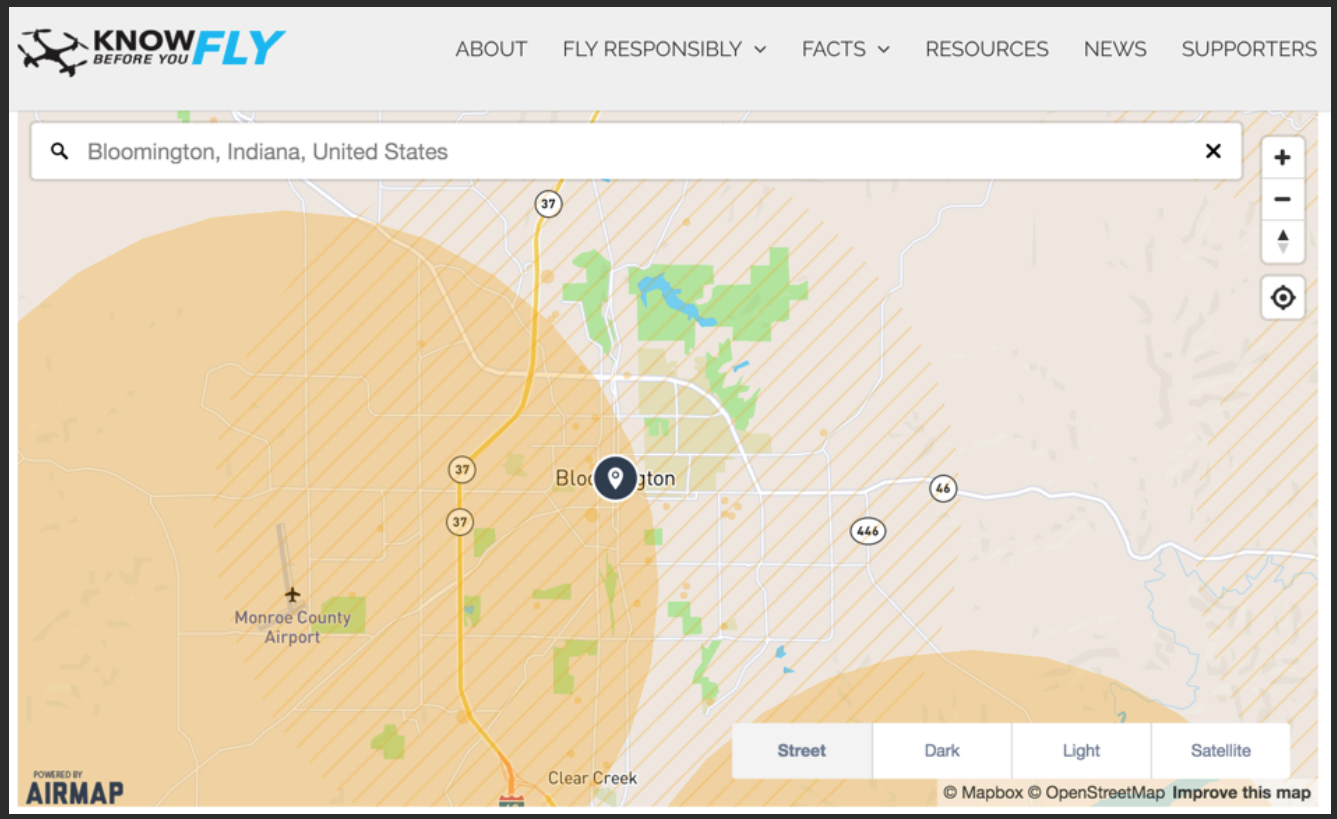
Know Before You Fly

Free for
iOS & Android.

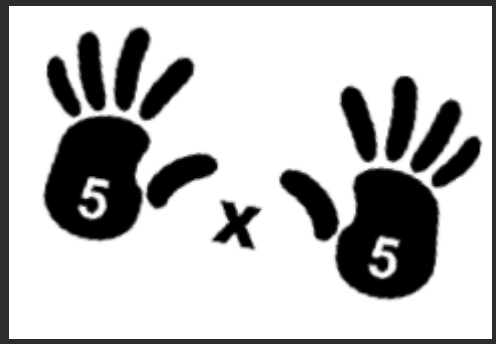
Check for specific restrictions in parks, near sensitive facilities, and places where you might disturb wildlife.

- Fly below 400 feet
- Keep your drone in eyesight always
- Stay clear of planes, helicopters, etc.
- Do not fly over people, wildlife, or vehicles
- Contact the airport &control tower before flying within five miles of an airport or heliport
- Check and follow all local laws and ordinances before flying

B4U Fly Map: http://knowbeforeyoufly.org/air-space-map/



Before you fly
Safety - Step Back 5x5 for Safety



- ❑ **STOP**
  - ❑ Put your drone down.
- ❑ **Take 5 steps back.**
- ❑ **Look around for 5 seconds.**
  - ❑ Look behind you too!
  - ❑ IDENTIFY & ASSESS hazards,
  - ❑ MAKE CHANGES if needed , SAFELY – complete your flight

Instructor: Data scribe - see anything?
Spotter- see anything?
Pilot - See anything?

Stop to address anything you see.

Instructor: Team, start your flight!

Pre-flight checklist: before every flight

Data Scribe: Read this checklist aloud, asking for the confirm / data from Spotter & Pilot.

Spotter/Safety Lead:

- ❑ **Weather conditions of flying area:** (Cloud Cover (%), Temperature, wind direction, speed, variability, humidity (optional))
- ❑ **Hazards present?** (yes/no/describe)
- ❑ **Takeoff/landing area established?**

Investigator Lead: science focused checklist:

TBD by the investigation

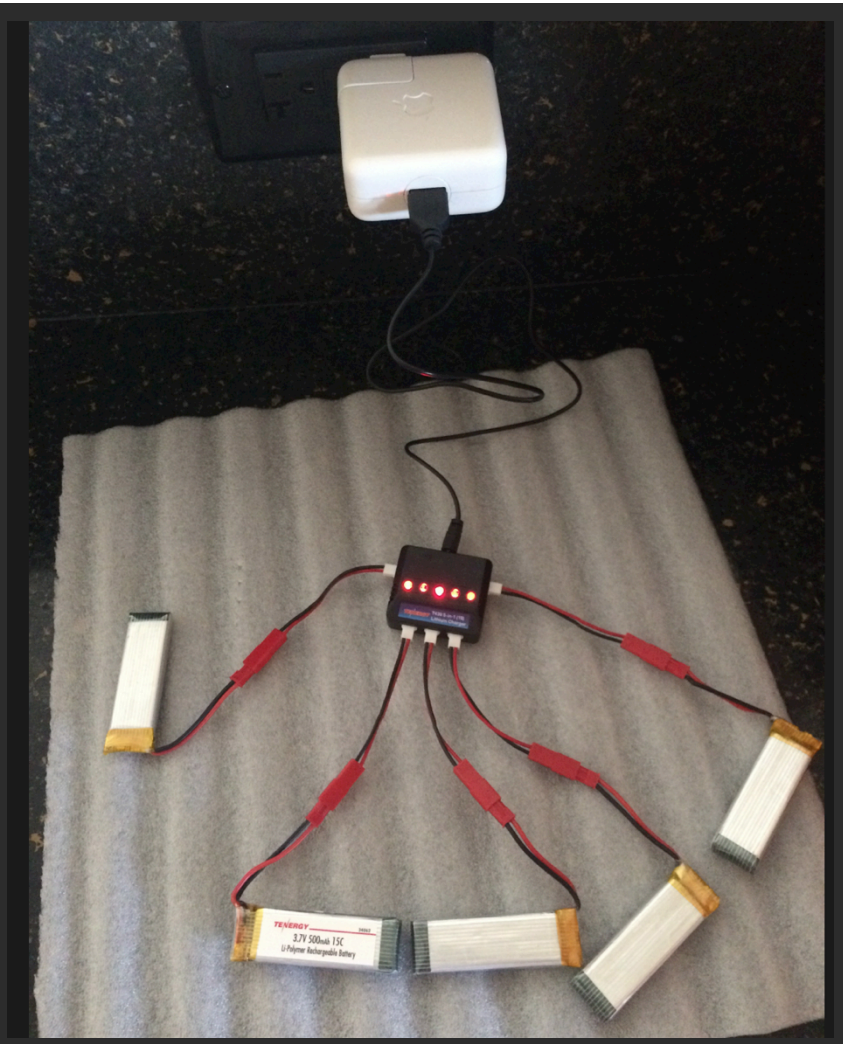
Pilot:

- ❑ **Drone checks:** Spin your props - secured? Check for loose parts. Battery is charged & connected. (opt) Payload secured?
- ❑ **Transmitter checks:** Battery is charged, Joy-sticks work.
- ❑ **Instrument checks:** Camera: Connected to power? SD card inserted? Sufficient storage available? Other sensors & equipment: Power on? memory card inserted? Sensor working? Secured to drone? Meter-circle in place?

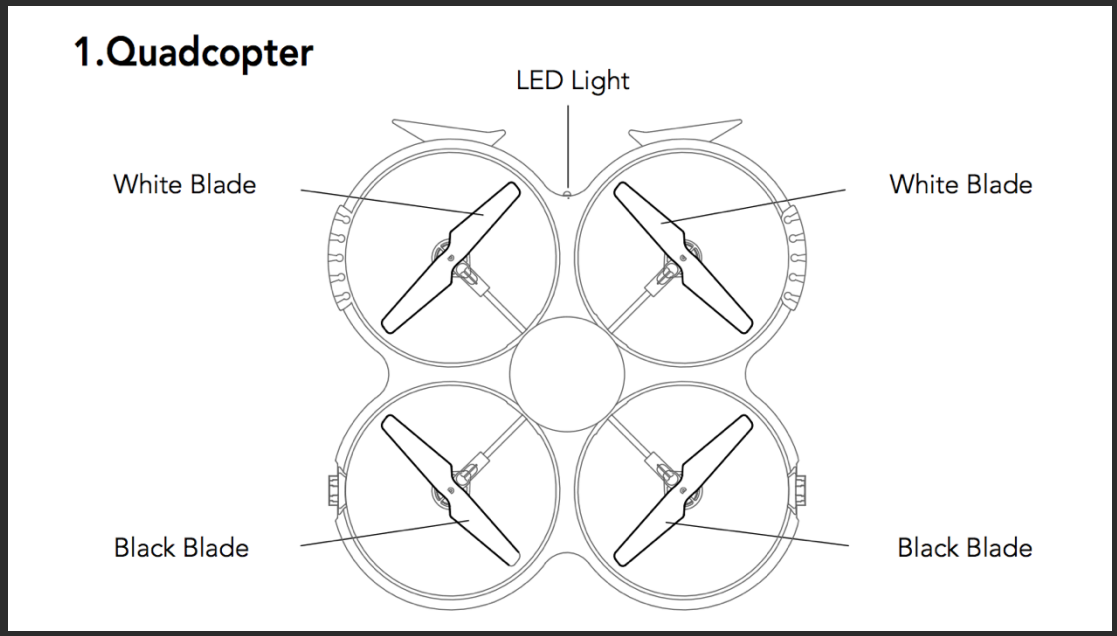
Everyone:

- ❑ **Step back 5x5 for safety**

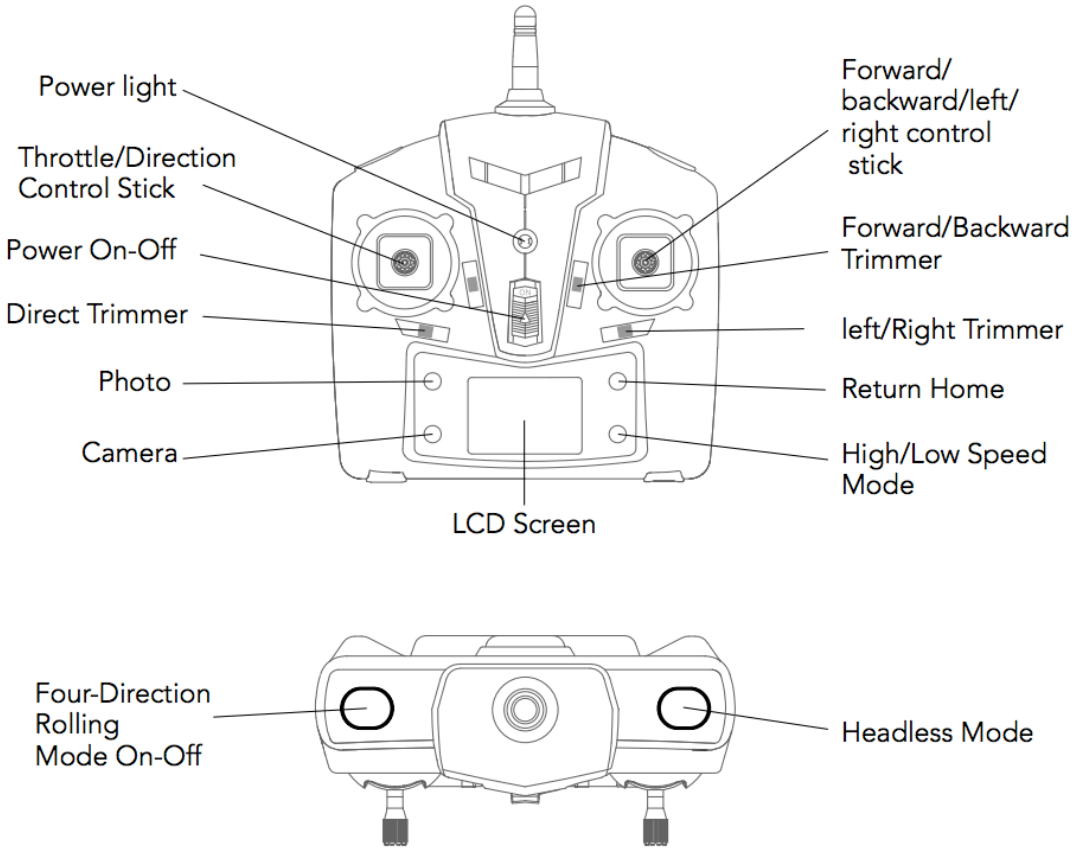

LI.PO
CHARGER
INPUT:DC 5V
OUTPUT:DC 600mAx2


TENERGY
3.7V 500mAh 15C
Li-Polymer Rechargeable Battery

5-minute Ground School



2.Transmitter



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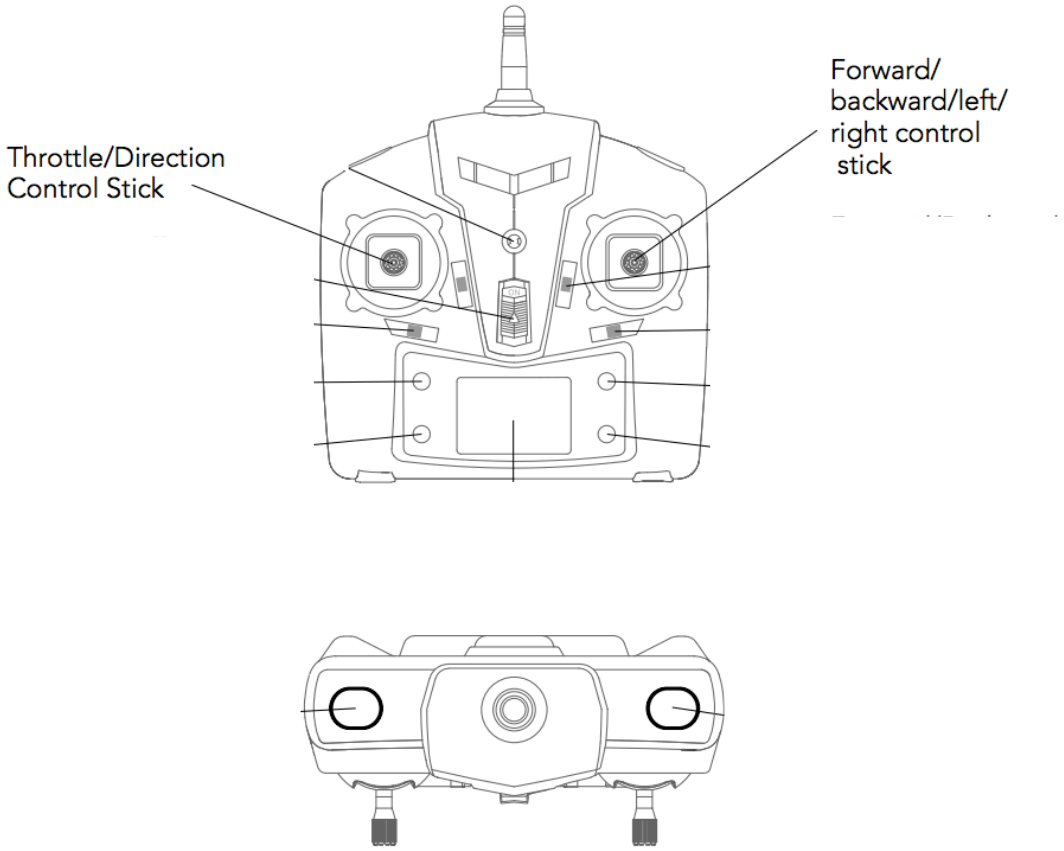
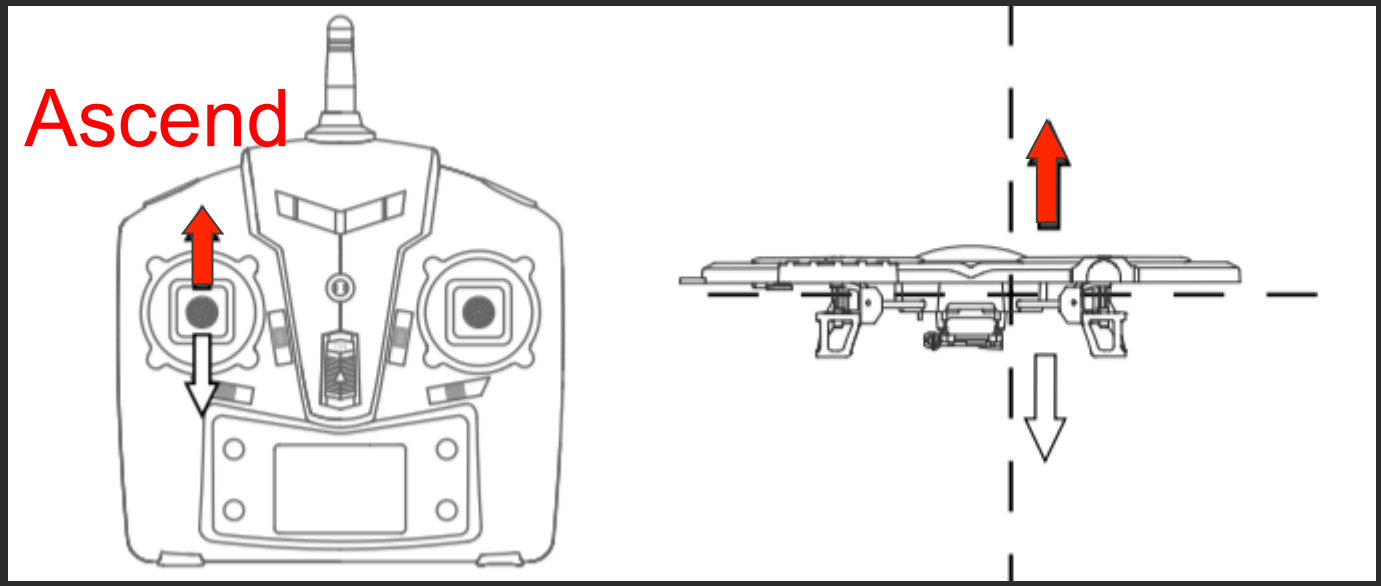
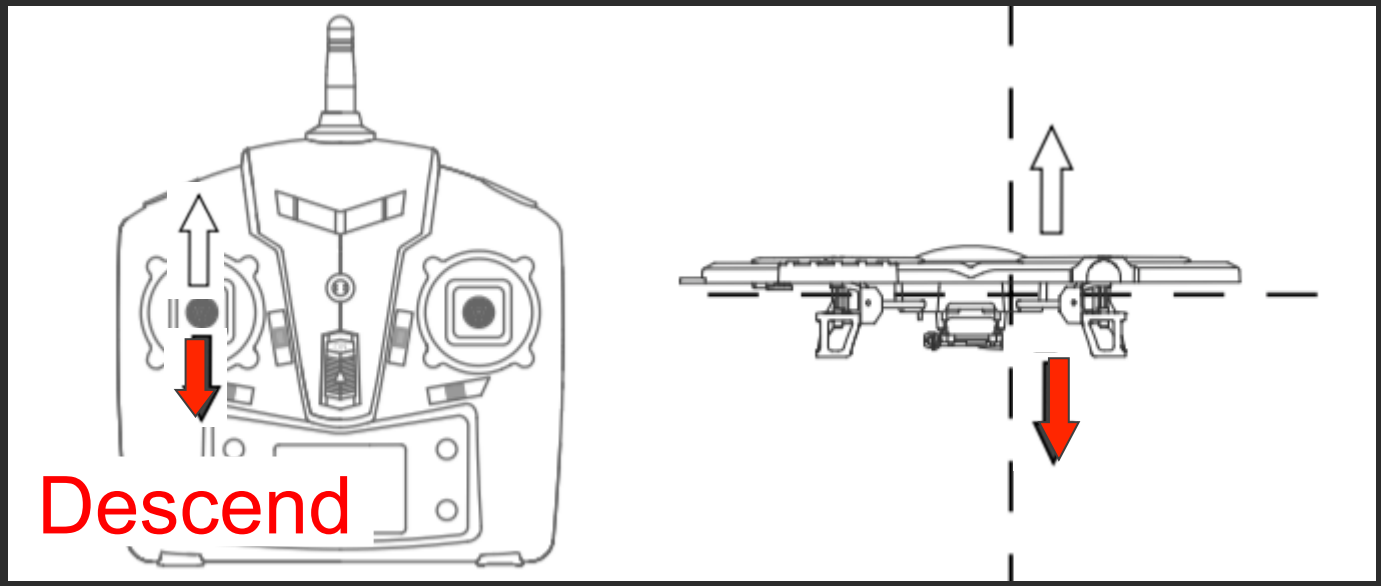
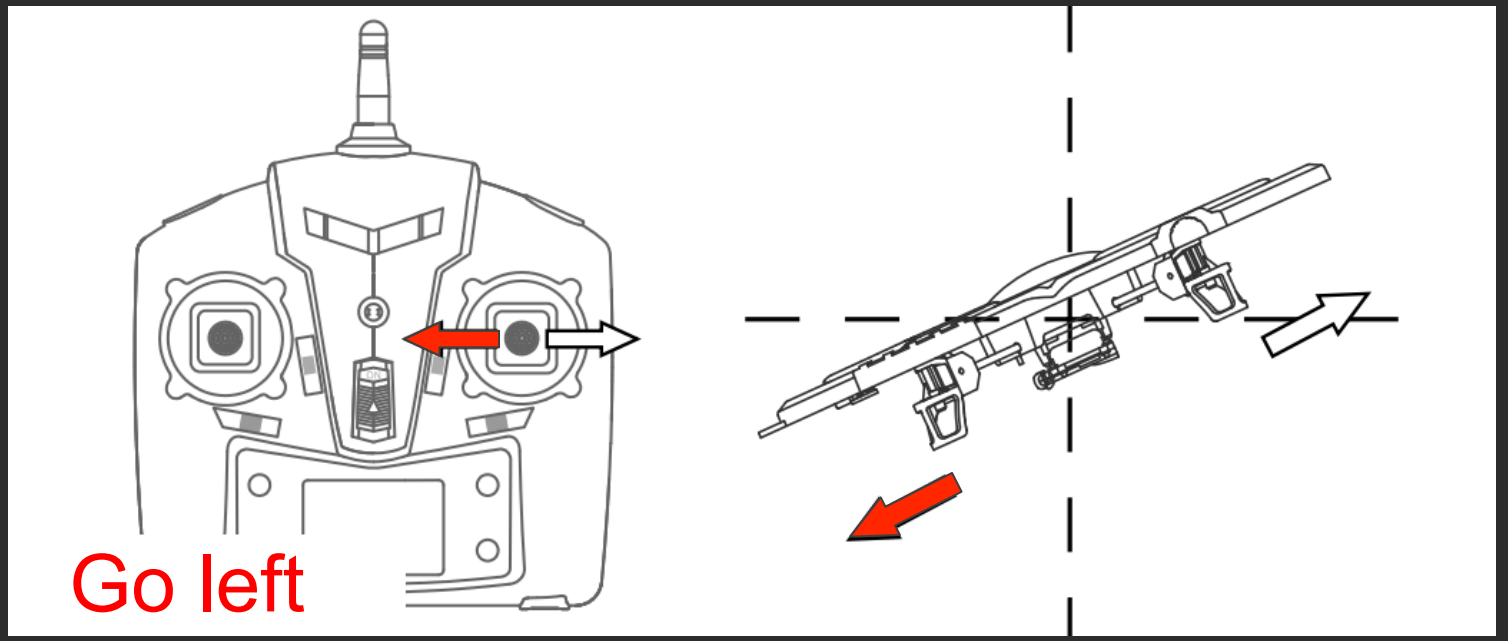
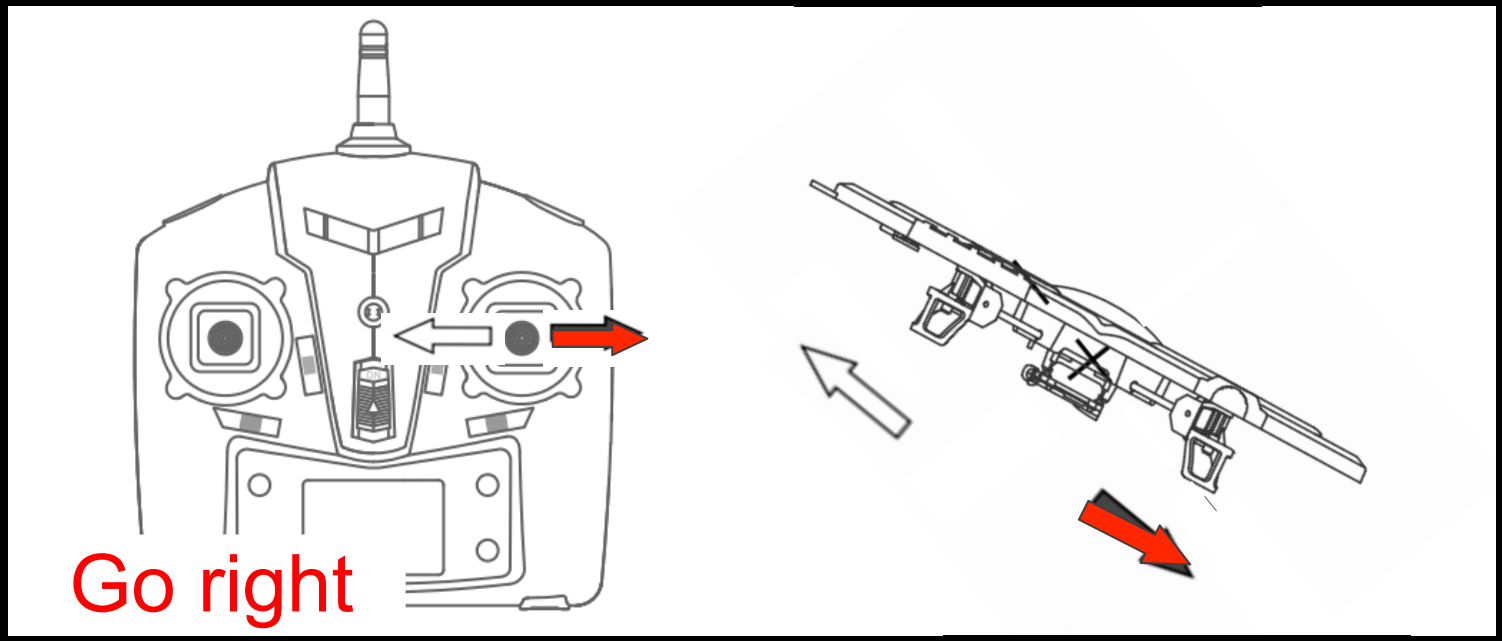
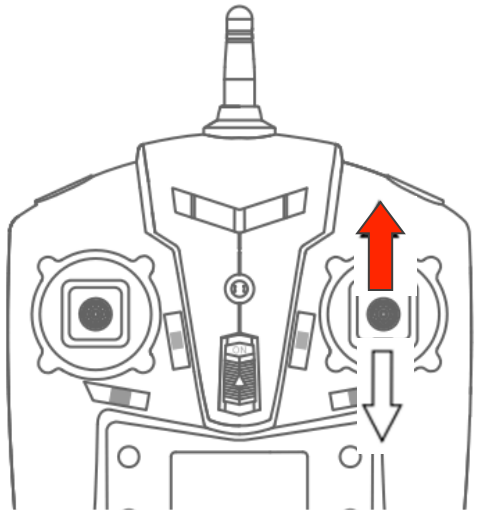


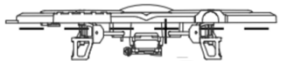

Ascend


Descend

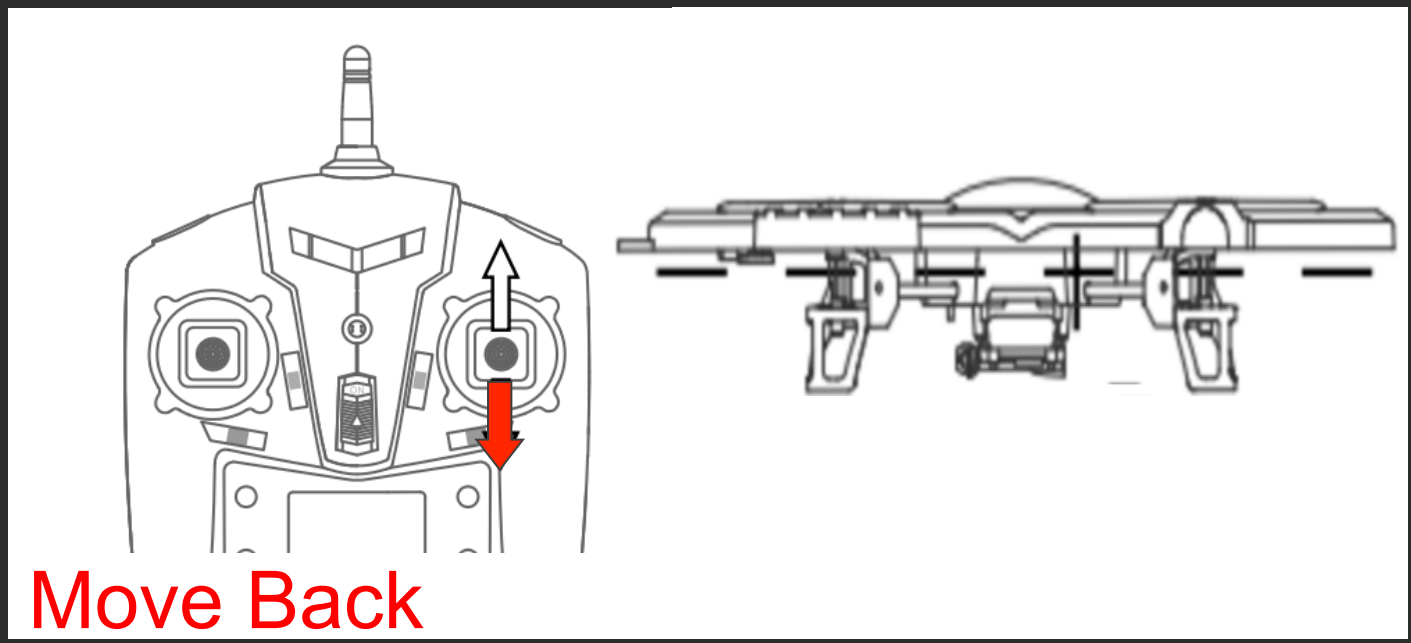

Go left


Go right

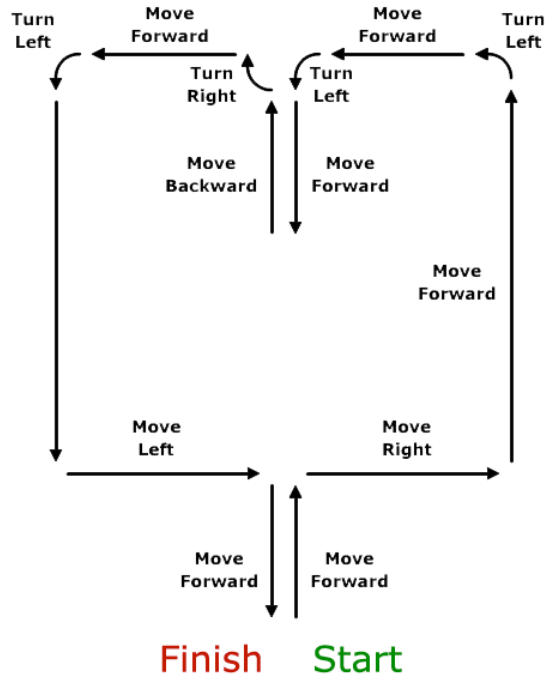




Move Forward


Move Back

Navigation practice with your transmitter - “Dry run”



1. To "Move Forward," push the **right** joystick forward, causing the Drone to pitch down. To "Move Backward," pull the right joystick back, causing the Drone to pitch up.

2. "Move Right" and "Move Left" are accomplished by moving the **right** joystick right or left, causing the Drone to **roll** right or left.

3. "Turn Right" and "Turn Left" are accomplished by moving the **left** joystick right or left, causing the Drone to **yaw** right or left.

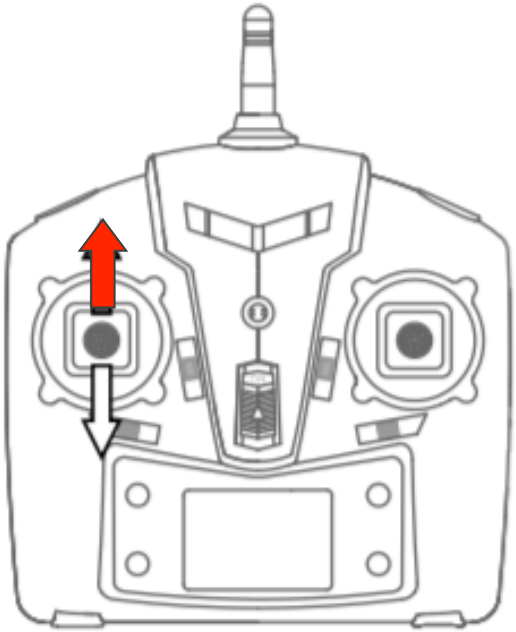
Pairing your transmitter and drone

(3) Please strictly obey the order of turn-on, turn-off before operation. When starting your flight,first turn on the transmitter,and connect power cable of quadcopter last; When finishing your flight,please disconnect the power cable of your quadcopter first turn off transmitter last A change in the order of connection may cause your quadcopter to lose control to threaten yourself and others safety. Please cultivate a correct habit of turn-on and turn-off.

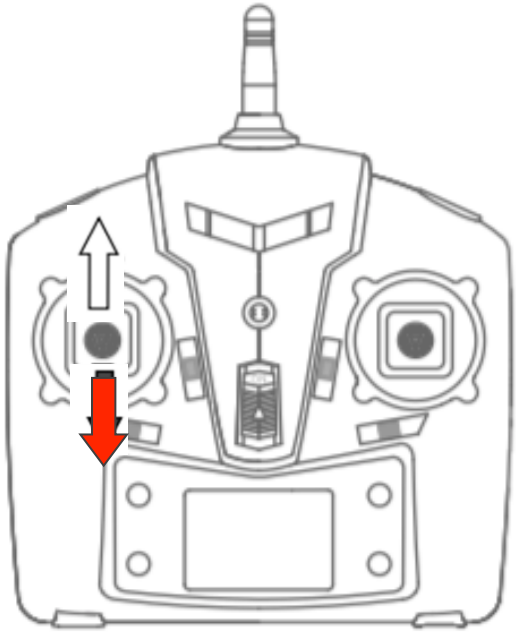
Message:
Use the transmitter to control your drone.

- Turn transmitter on first
  - Plug battery into drone
    - Place drone on level surface
    - Pair the two
    - Fly!
  - Unplug battery from drone
- Turn transmitter OFF last

1

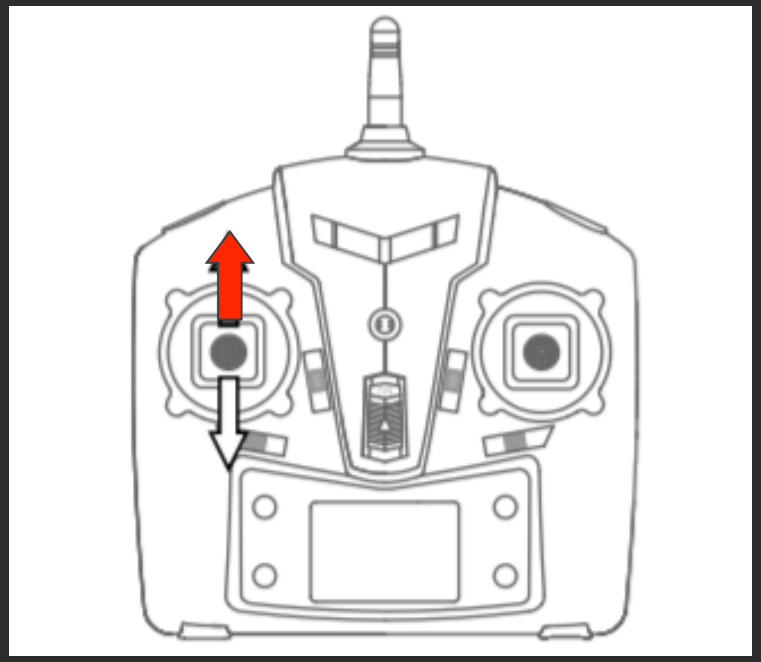


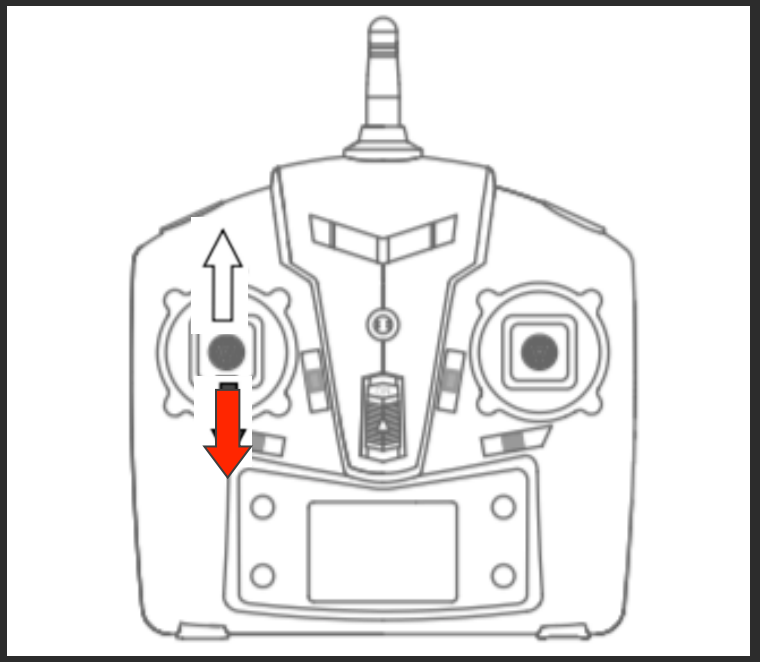
2



Pairing the transmitter with your drone

To pair: Move the left stick all the way to top, then all the way to the bottom.
You should hear a beep, light on the transmitter & drone will go from flashing to solid





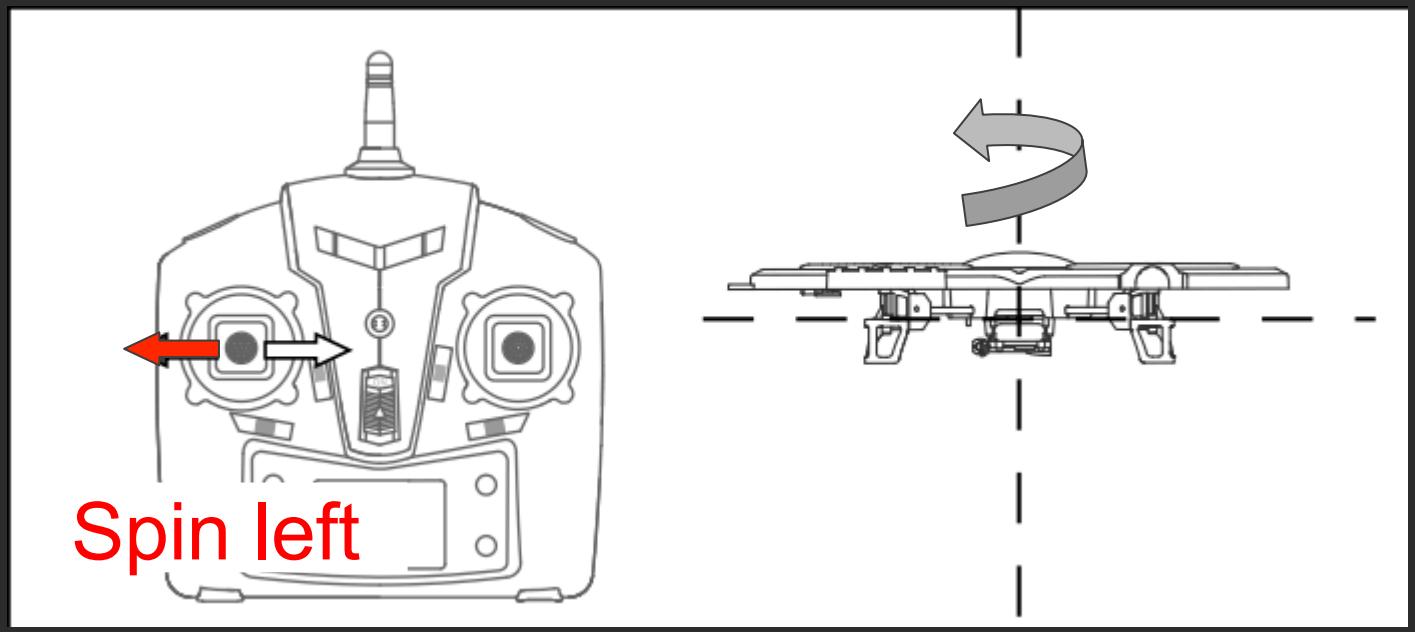
Pairing the transmitter with your drone

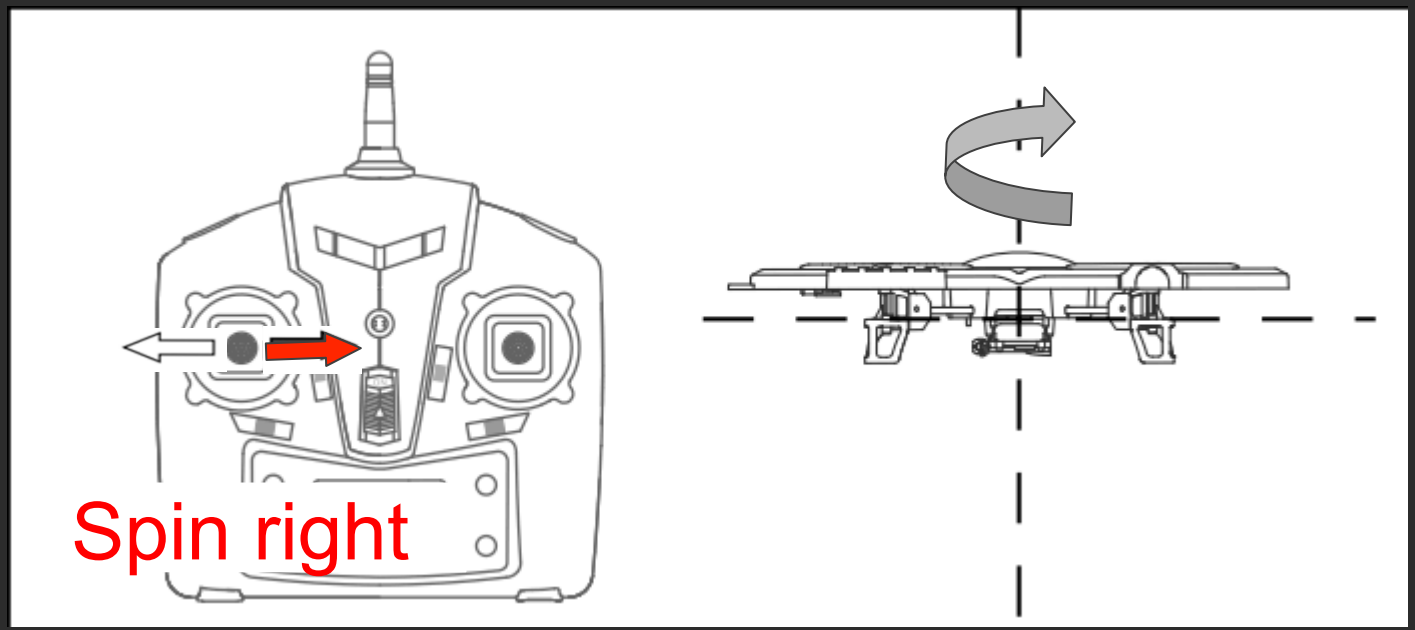
Once paired, the transmitter’s flashing blue light turns steady

You’re ready to fly!

This model is fairly sensitive. Achieving a steady hover may require continual small adjustments.

And here’s one more move you can make... when you’re ready


Spin left

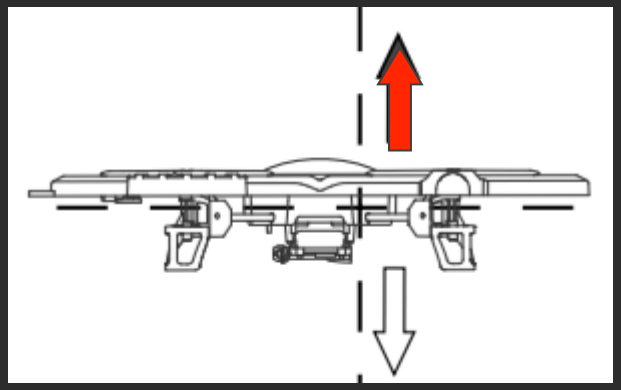

Spin right

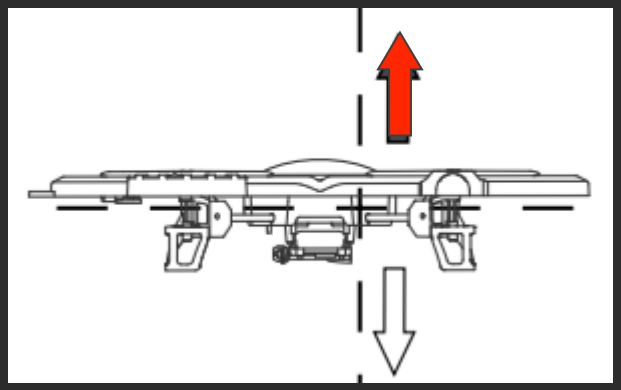
Part 1: Flying practice time!

- Turn transmitter on first
  - Plug battery into drone
  - Place drone on level surface
    - Blue light is flashing on drone
  - Pair the two
    - Left stick (Throttle) - up, down
    - Check that the blue light is steady!!
  - IF YOUR LIGHT IS STILL BLINKING ---> DO NOT TRY TO FLY!
  - Fly!
- Unplug battery from drone
- Turn transmitter OFF last

Part 1: Flying practice time!

- Take off - Hover - Land
- Fly left - Fly right
- Fly away - Fly back
- *Repeat until comfortable*





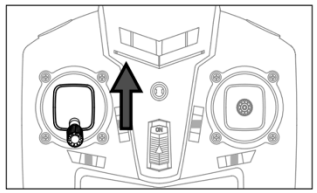
What if my drone won’t fly straight?

Calibrate

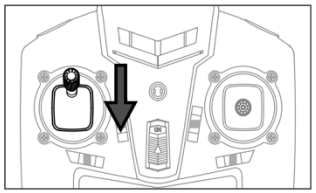
Calibration instructions:

When the quadcopter takes off hovering can't be adjusted by trim and causes difficultoperation, then please adjust the quadcopter according to below steps:

1. Pull out the power of quadcopter, power off the transmitter;
2. Power on the transmitter, push the throttle stick to utmost and then back to lowest position.(see pic 1/2),then the transmitter is ready to code pairing.

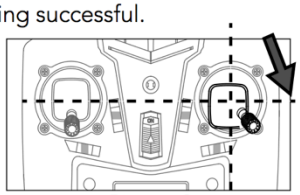


Picture 1



Picture 2

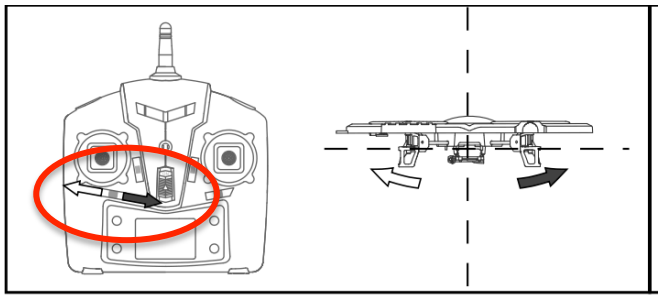
3. Power on the quadcopter and put it on a level surface, about 3 seconds later, you will hear "di,do,di ", and it shows code pairing successful.
4. It's not allowed to push the throttle stick before adjustment. Operate the transmitter stick forward and backward/ left and right to the lower right corner (see pic 3), then quadcopter gets a solid light and no more flashing, it shows adjustment finished and quadcopter is ready to fly.



Picture 3

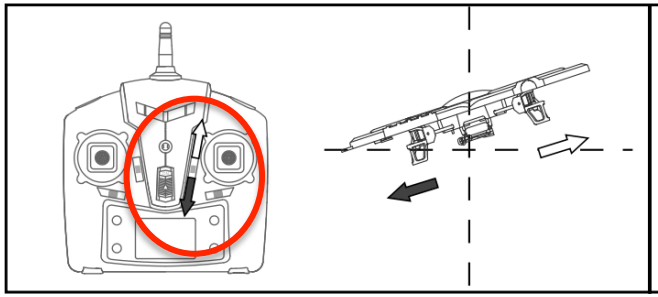
Calibration steps

- Turn transmitter off & unplug battery on drone.
- Turn transmitter on
- Push throttle up then down
  - Plug battery into drone
    - Place drone on level surface
    - Push <u>right</u> control forward and back, left and right, and into **lower right corner**



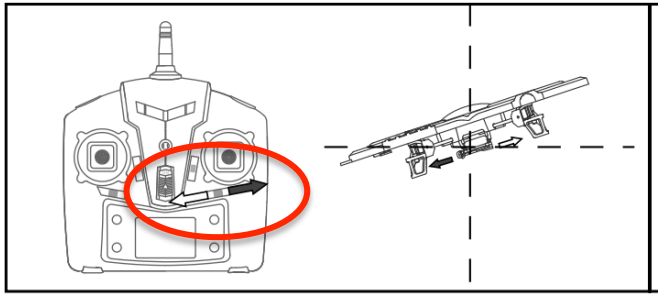
When taking off, the body head drifts to left,then adjusts right rudder trim, otherwise left rudder trim.

5. Adjust left and right rudder trim



When taking off, the body drifts forward, then adjusts backward trim, otherwise forward trim.

6. Adjust forward and backward trim



When taking off,the body drifts to left, then adjusts right trim, otherwise left trim.

7. Left & right trimmer

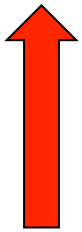
Adjusting Trim

Figure out which direction the drone drifts.

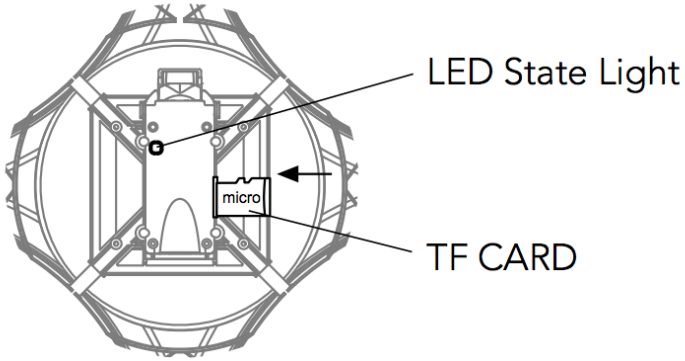
In a low flight adjust the appropriate trim button.

Group photo !

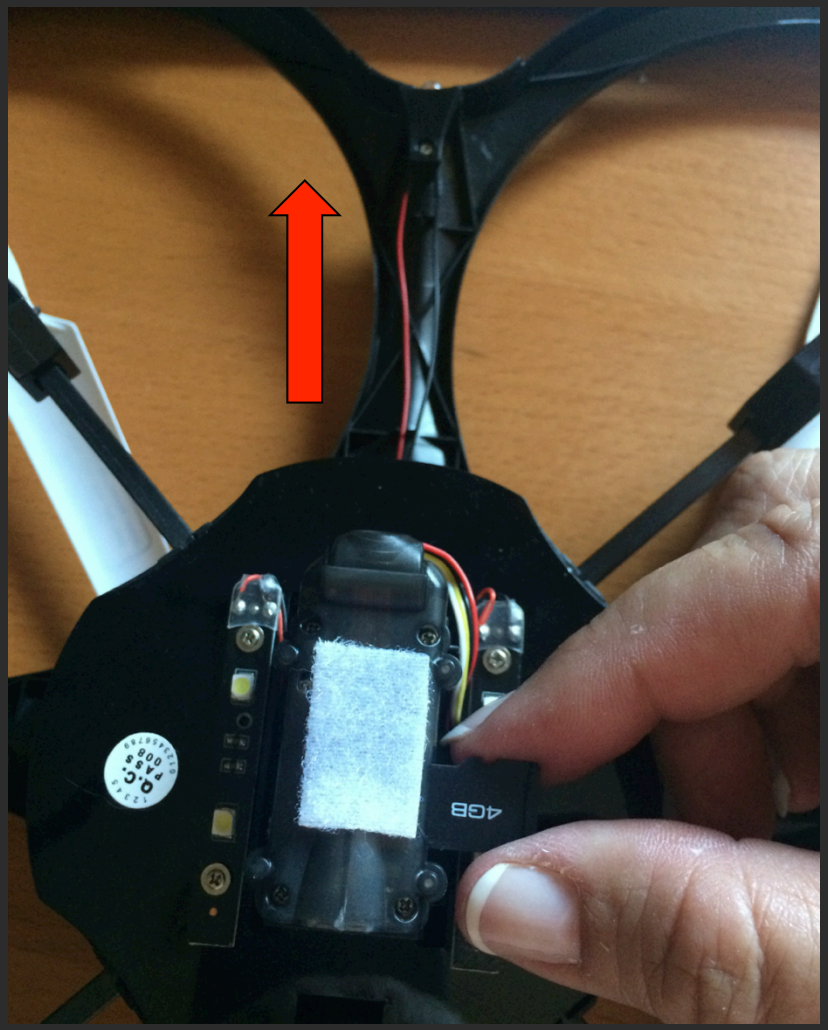
Taking photos and videos with your drone



Front of drone
(headlight)



Inserting your TF (Micro SD) card



Inserting your TF (Micro SD) card

Modifying your camera to point down

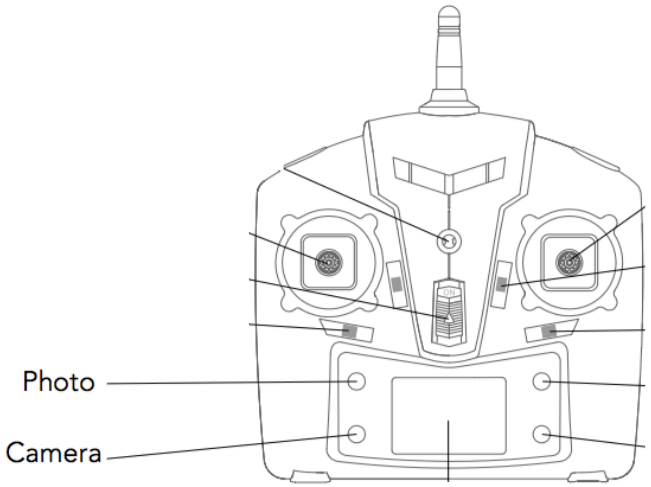


Photo
Camera

Part 2: Try out an activity

Work in a small group

Choose an activity

The Science / Flight Team & Roles

Data Collector/ Photo Roles:

Pre-flight

- Check instruments/ sensors
- Call out pre-flight checklist items
- Complete the Flight Datasheet

In-flight

- Read out investigation instructions
- Record data collected during flight

Post-flight

- Call out post-flight checklist

Spotter/Safety Lead Roles:

Pre-flight

- Describe weather data
- Check surroundings for obstacles & hazards

In-flight

- Keep drone in site
- Scan surroundings
- Read off data to Data Collector (optional)

Post-flight

- Check area for hazards
- Retrieve with photo/ sensor data from drone (optional)

Pilot Roles:

Pre-flight

- Check the drone
- Check instruments/ sensors attachment

In-flight

- Fly the drone – follow instructions from Data Collector
- Keep drone in site & lands safely

Post-flight

- Turn off drone
- Retrieve drone
- Check drone & charge batteries

Part 2: Try out an activity

Work in a small group

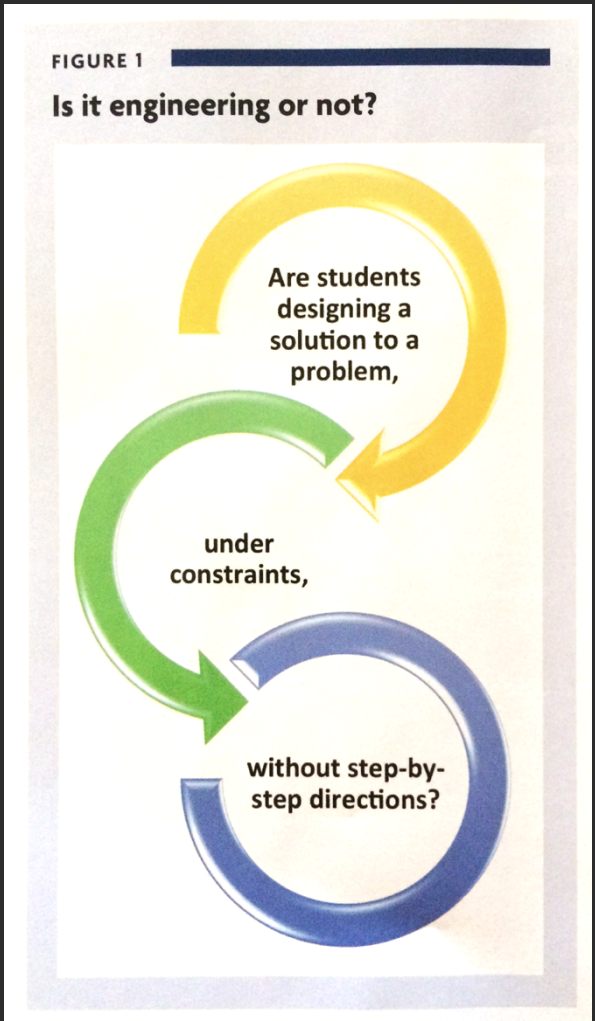
Choose an activity:

How much weight can my drone carry?

https://scied.ucar.edu/activity/uav-test-carry-payload

How high is my drone flying?

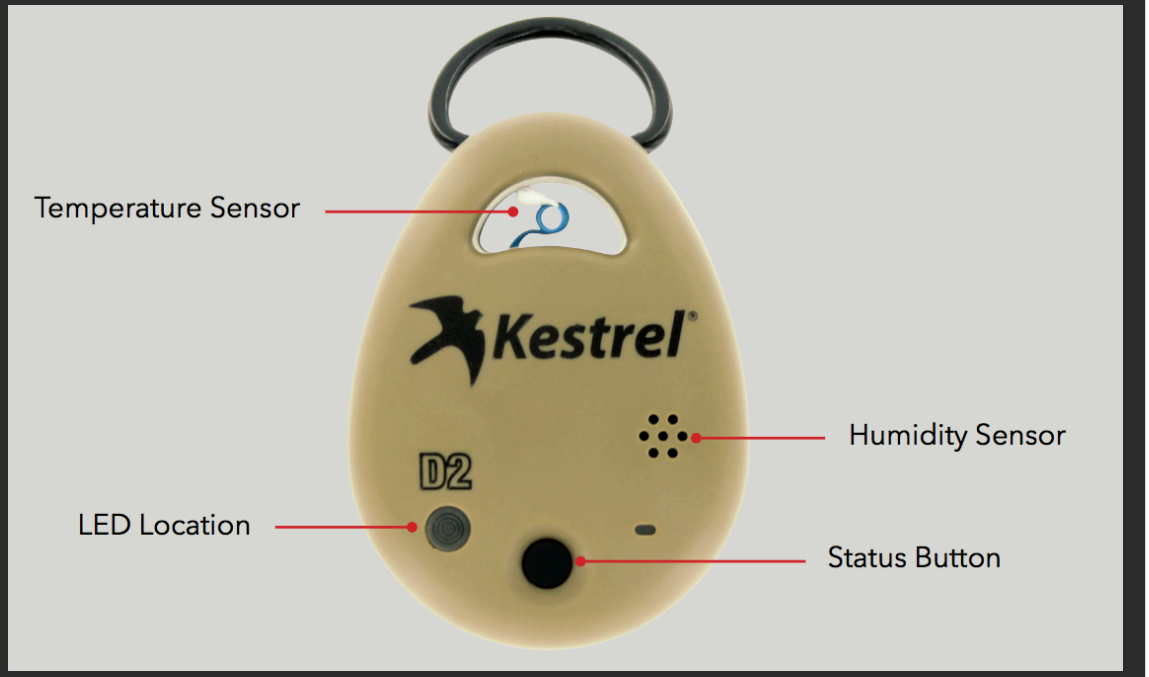
https://scied.ucar.edu/activity/uav-test-altitude



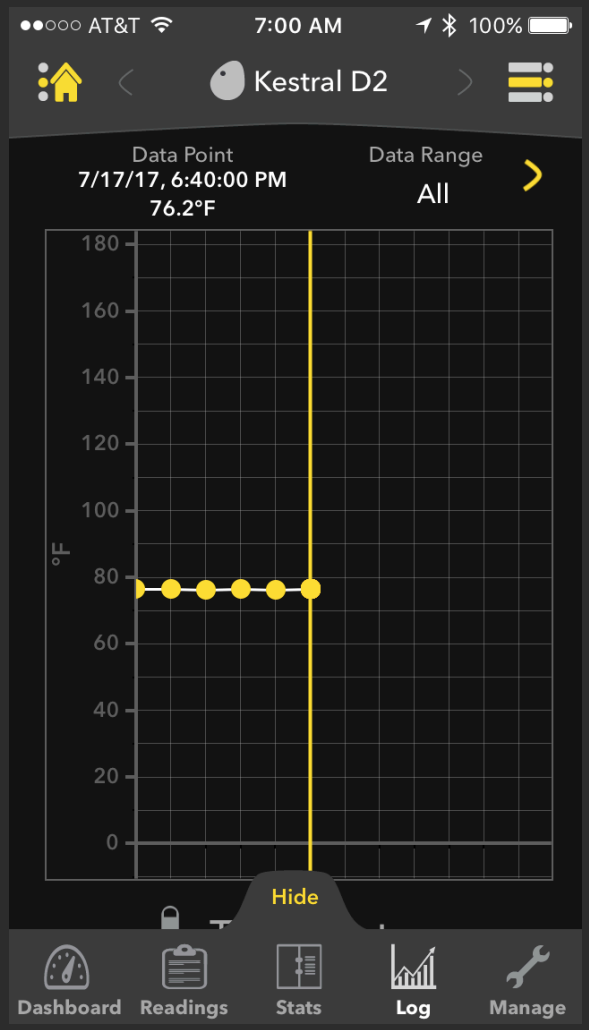
Discussion: What skills / resources do you need to use your drone for STEM learning?

Is it Engineering or Not?
The Science Teacher
Summer 2017
Brooke A. Whitworth and Lindsay B. Wheeler

Part 3: Sensors


Temperature Sensor
Kestrel
D2
Humidity Sensor
LED Location
Status Button


AT&T
2:15 PM
drop 4
Readings
Reading Date
9/2/14, 2:15:08 PM
Refresh Rate
5 seconds
Temperature
79.1°F
Relative Humidity
57.8%
HI
Heat Stress Index
79.7°F
DP
Dew Point
63.0°F
Hide
Dashboard
Readings
Stats
Log
Manage


●●○○○ AT&T
7:00 AM
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Data Point
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76.2°F
Data Range
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Hide
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Stats
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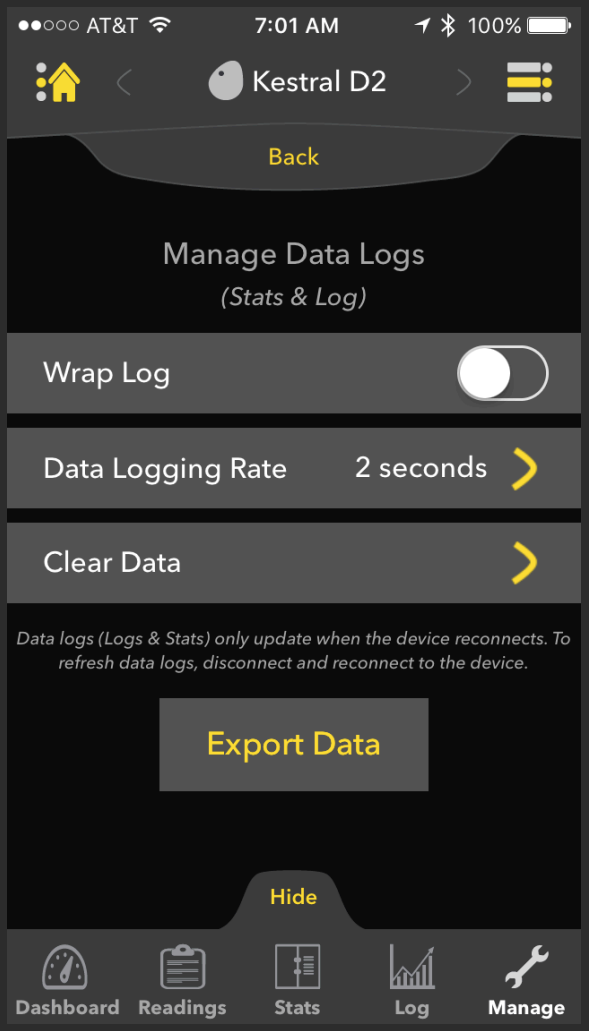
●●○○○ AT&T
7:01 AM
100%
Kestral D2
Back
Manage Data Logs
(Stats & Log)
Wrap Log
Data Logging Rate
2 seconds
Clear Data
Data logs (Logs & Stats) only update when the device reconnects. To refresh data logs, disconnect and reconnect to the device.
Export Data
Hide
Dashboard
Readings
Stats
Log
Manage

Press On/Off for 3 seconds:
Solid blue light = standby mode

Mode button toggles between
Blue: 720 p video
Blue+Red: 1080 p video
Red: Photo

Press on/off to start and stop video or take a photo

When starting video, light flashes 3 times, then goes out.

Camera

The PocketLab: pic.twitter.com/uDlKjxw695

	PocketLab One	PocketLab Weather	PocketLab Voyager
Acceleration	●		●
Angular Velocity	●		●
Magnetic Field	●		●
Rangefinder			●
Altitude	●	●	●
Pressure	●	●	●
Ambient Temperature	●	●	●
Temperature Probe		●	●
Humidity		●	●
Light		●	●
Dew Point		●	●
Heat Index		●	●
Bluetooth	●	●	●
On-Board Memory		●	●
Price	$98	$98	$148
Activities	70+	20+	90+

Brainstorming: Using drones & sensors in classroom

Action plans - what are you going to do as a result of this workshop?

Flying with your drone - eg on a plane in the United States

Place the batteries in your CARRY ON luggage.

These are lithium ion batteries

Carry on luggage. Not checked. Not gate checked. Etc :)

Check TSA regulations before taking your drone

Back-up slides

Back-up slides

Resources: UAV Flight School https://scied.ucar.edu/activity/uav-flight-school

Resources: Learning the aerodynamics of flying

Learning the aerodynamics of flying