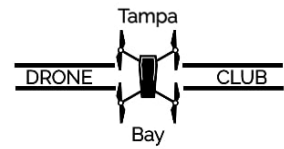


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### Building a FPV (First Person-View-Drone)

*Stuff Needed To Build an FPV Quadcopter:*

- 4 x Motors
- 1x FPV Drone Frame
- 1x Drone Battery is.
- 1x Transmitter Receiver
- 1x FPV VTX Transmitter (Digital Or Analog)
- 1x FPV Receiver/Goggles (Digital Or Analog)

#### 1. Select a durable carbon fiber frame:



NOTE: you will need to fully assemble the frame before attaching components. Depending on your frame size, it will determine the type of components used. We will be building a five" FPV Drone (Which is standard) for carrying a GoPro or similar action camera.

#### 2. Figure out The Mounting pattern (or size of the ESC & FC Area)

Specifications

Wheelbase 5": 220mm

Top Plate: 2mm

Bottom Plate: 3mm

Standoff height: 25mm

Arm thickness: 4mm.

**Stack Mounting: 30.5 × 30.5mm & 20mm x 20mm.**

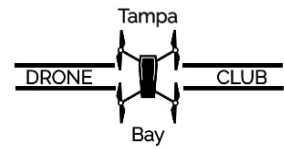
Weight 5": 72g

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### 3. Choosing Battery Size

Next step is to choose battery size. Fours will give you cheaper batteries (and lighter weight) but will not have the same power as a 6s. 6s will give you more power, but batteries are generally more expensive, and components must be rated for sixes voltage.



Fours battery

6s battery

### 4. Choosing Components

You must now choose components, depending on your **stack mounting pattern, battery size, frame dimensions, VTX System, and RC Transmitter**

| System            | 4s battery                           | 6s battery                   |
|-------------------|--------------------------------------|------------------------------|
| Battery           | Max: 16.8v Min: 12.00v               | Max: 25.2v Min: 19.8v        |
| Motor Size        | 2207, 2306                           | 2207, 2208, 2308, 2407       |
| ESC               | Any ESC With Rating Up to 6s Voltage | Only ESC 6s or over voltage. |
| Flight Controller | Any Within Size Range                | Any Within Size Range        |
| VTX/Video System  | Digital Or Analog                    | Digital Or Analog            |
| RC Receiver       | TBS Crossfire, Express LRS           | TBS Crossfire, Express LRS   |

Choosing an RC Receiver:

You should choose a receiver on the quadcopter that matches your transmitter. There are multiple options as of 2025, and you should review to ensure that it is a system you want/have.

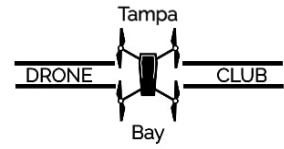
- TBS Crossfire: Long-Range (900 mhz) system invented in 2015 and has many years of reliable solid performance. This is not open source, and locked software, but does receive frequent updates, and does work “Every-time” **Generally, the most expensive system you can get for a receiver but does work all the time.**
- Express LRS: Long-Range (Multiple options mhz) system invented to be an open-source system. This requires the pilot/builder to flash firmware onto components and set them up manually. This generally has more features but will require manual updates and firmware flashes that can be considered tricky or time-consuming. **Components are cheap, and multiple companies make parts for this system, but do lack quality control/ease of use.**

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### 5. Choosing a VIDEO system/VTX

#### Digital Options:

- **DJI:** Generally, the most expensive system on the market, a big positive of this system of its ease of use. This system is not open source, meaning you cannot adjust/ticker with software or update its feature set. Many flight controllers have built in “Digital” Plugs to match with this system and could be considered plug n play. Typically, DJI Has the best range and video quality, but that comes with a higher price tag.



*DJI Air Unit*



*DJI 03 Unit*



*DJI 04 Air Unit*

NOTE: Depending on your air unit, the correct type of DJI Goggles will need to be purchased. Goggles are typically not backwards compatible in the DJI Ecosystem.

If you plan on racing, many organizations do not allow DJI/HD Systems due to interferences from the goggles and VTX transmitter; however, we do allow all HD Systems on our racing events and all events we run are posted on our website: [tampabaydroneclub.com/drone-racing](http://tampabaydroneclub.com/drone-racing).

- **HD Zero:** Is a semi-open-sourced HD video link. Unlike DJI, this system offers more options from multiple manufacturers. It is great if you want to have a better video link than analog, but still need low latency for racing, etc. It does not have the highest penetration or video range. The Hardware is open source, but the software is locked.



*HDZero Race V3*



*HDZero Freestyle*

NOTE: HD Zero only currently has one set of goggles. Backwards Compatibility is not known at this time.

#### Analog Options:

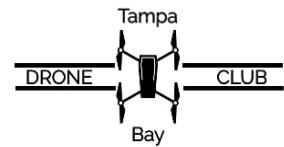
- Analog Nowadays is considered old-school. While some manufacturers will still make VTX we don’t recommend unless you plan on racing or need the lower latency video link. For Racing, MultiGP Allows HD Zero along with older analog systems during racing.

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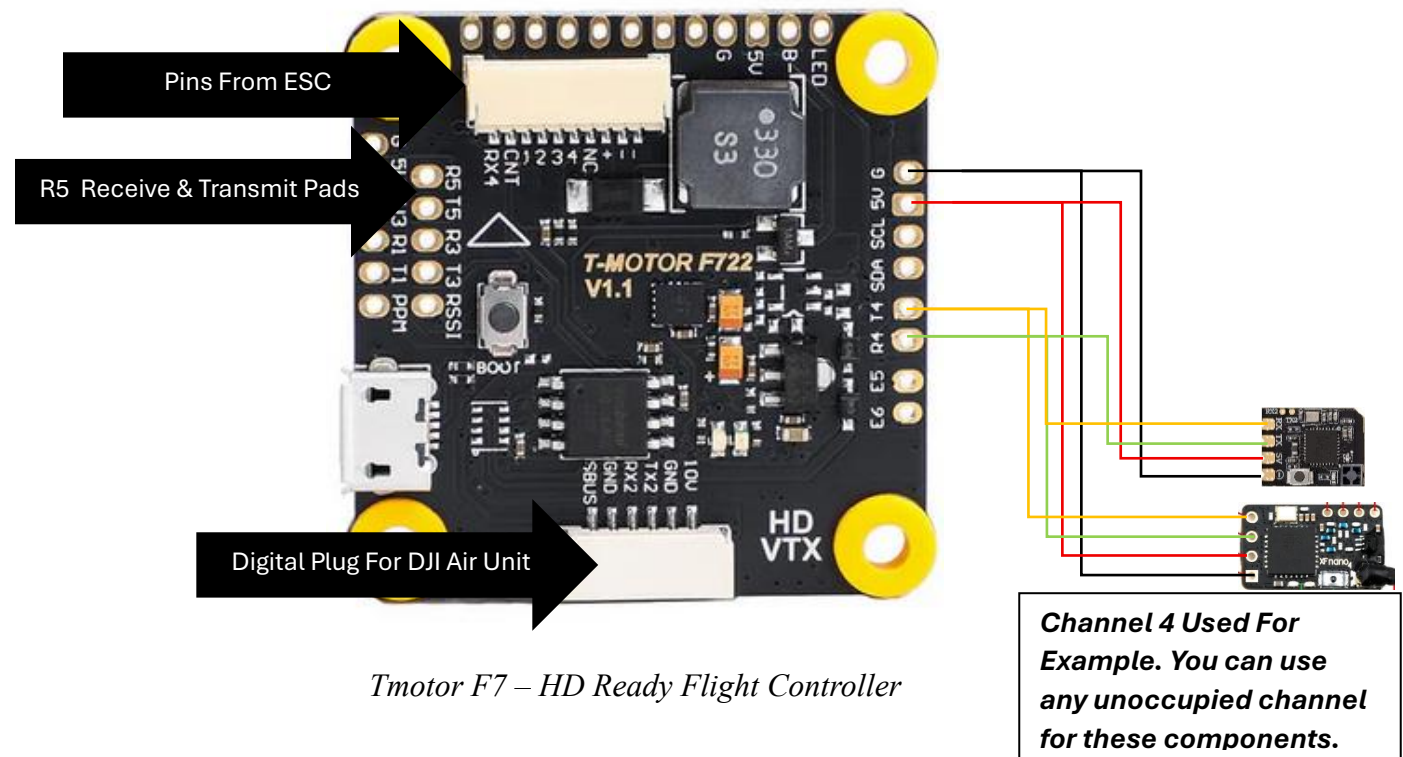
### 6. Flight Controller Soldering Points

Typically, Flight Controllers Regardless of size, will contain solder pads. Depending on the additional components you use, it will determine the number of soldering joints you will need. The Arrow printed should be pointed in the forward or N direction, this is to help the magnetometers figure out left from right side.

Example: If you need to wire an additional RC Receiver, you will need to solder at least 1 connection (typically numbered as R1 and T1. R1 Means transmitted signal and R1 mean Received signal. For many “smart” applications, both signal wires are required.

A Flight controller can have 3 or more “channels” to assign components to. Typically, a pre-wired digital plug will be wired into an existing channel on the FC.

**Pay Special attention to the wiring, as there is no polarity protection! Failure to wire + / and – will short circuit the board and you will need to replace components!**



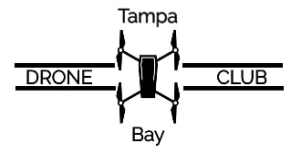
NOTE: By Default, Beta Flight Application will not know what you wire each channel to. You must assign each channel to the software before using it. **Do not remove/disable the USB channel or you may not be able to flash it again.**

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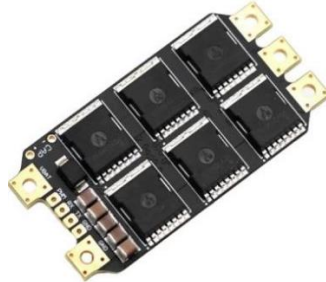
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### 7. Electronic Speed Controller (ESC) Soldering Points

ESC or Electronic Speed Controllers, Take the full battery voltage and direct each individual motor, turning them on/off as necessary. These components used to be 4 individual parts and nowadays can be combined into one PCB mounted under the flight controller. The ESC is controlled by the microprocessor on the flight controller & software.



**PRO TIP: Higher Amperage ESC will give you bigger overhead from brownouts. We recommend at least 45amp for 5-inch FPV Drone!**

4 In One ESC

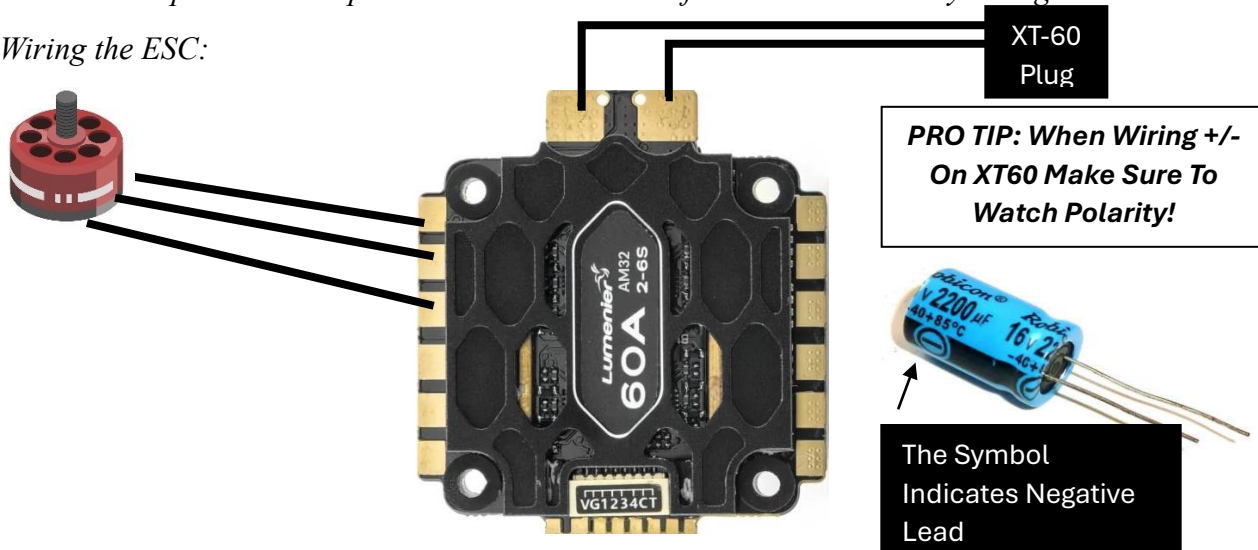
Individual ESC (Old)

The plug-in pad is typically for the flight controller. Note: **You can use different esc & flight controller manufacturers, however, do check the plugs and re-pin the plug, as necessary. It is extremely important to wire the correct pins, or you may fry the ESC!**

**Special Note: If you plan on flying a 6s a capacitor is necessary & required. We recommend that you solder in the provided capacitor even if u don't plan on flying 6s.**

*Picture Example Is a 60Amp AM32 ESC and is rated for 2-6s LIPO battery voltage.*

*Wiring the ESC:*



3 Wires on the FET pads don't matter direction, as long as the middle wire stays the same. The 2 exterior wires can be swapped to switch motor directions. You can also do this with Betaflight Software.

For Capacitors wire the “-“ or negative leg on the – (negative) battery pad. Failure to wire this will fry the capacitor.

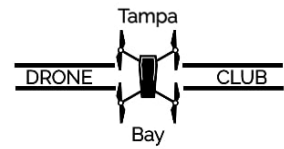


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### 8. BetaFlight Application

Betaflight Software is the open-source software that resides on the flight controller (FC) and controls the flight and takes input from the pilot and translates that into real-world outputs.

Because this is open source, many pilots find the application side of this extremely confusing.

*There is also numerous tuning, and other options will not be discussed in this guide.*

*Download BetaFlight Application:*

- <https://betaflight.com/download>
- We have a web-based Betaflight App:
  - <https://www.tampabaydroneclub.com/betaflight-app>
- Speedy bee App (If your FC Supports it)
  - IOS: <https://apps.apple.com/us/app/speedybee-app/id1150315028>
  - Android: [https://play.google.com/store/apps/details?id=com.runcam.android.runcam&hl=en\\_US](https://play.google.com/store/apps/details?id=com.runcam.android.runcam&hl=en_US)

Scan For Windows

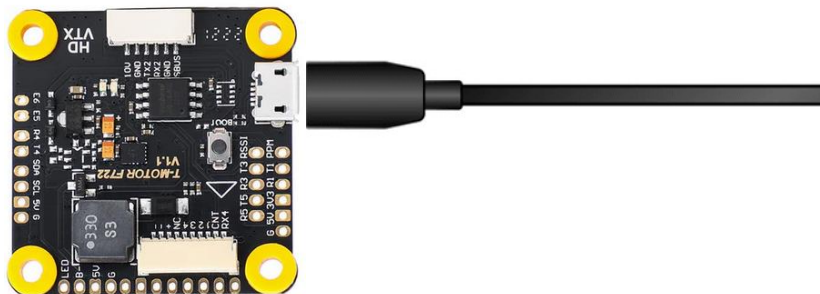
Scan For Android

Scan for IOS.

**Before Plugging in your quadcopter, allow your PC to download necessary drivers & updates, Follow betafights driver requirements on their application page!**

Plug In your FC Via USB:

(Some FCs may require an additional power source)



Understanding the Icons:



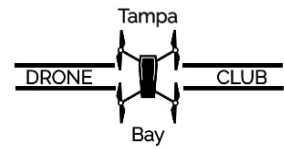
When Plugging in you may see 3 or more icons depending on your setup. If your quadcopter is reading & equipped with any of these sensors you may get a status light. When GPS is enabled it will turn **red** when no GPS sats are located and **green** when sats are found.

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### Select Receiver:

You should select the known receiver protocol for the sticks & switches to work.

Receiver

Serial (via UART)

Receiver Mode

• The UART for the receiver must be set to 'Serial Rx' (in the Ports tab)

• Select the correct data format from the drop-down, below:

CRSF

Serial Receiver Provider

*Example: Crossfire Nano RX Receiver Setup.*

### Setting Up Transmitter Channels

Most Quadcopters use AETR (Aileron, Elevator, Throttle, Rudder) configuration. Make sure the channel in beta flight is mapped to show this. Your transmitter may have to follow this configuration as well and may require an additional step.

Channel Map

AETR1234

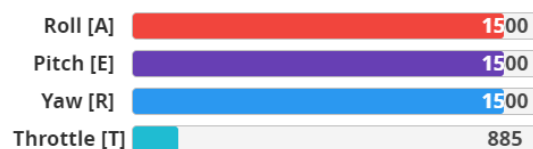
### Understanding Stick Movement:

You should power your receiver if you don't have power over USB to test these functions.

1. Test Roll Sticks
2. Test Pitch Sticks
3. Test Yaw Sticks
4. Test Throttle Sticks

Ideally 1500 is the “Center-point” for sticks. You should see this bar move up/down depending on your stick.

When you move the stick in any direction, the particular movement should be mapped in betaflight, if you don't see movement your channel map or transmitter is not mapping the correct movement.



NOTE: The 3d Preview Model Should Also Reflect the movement of the sticks. This will be how the quadcopter acts once it is removed from betaflight.

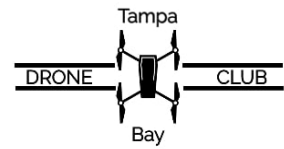


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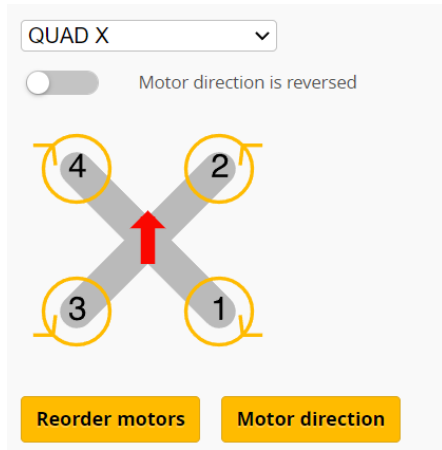
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### Motor Directions

BetaFlight can be mapped to fly in any motor direction although by default the Quad\_X Configuration is most common.



You should have 2 CW and 2CCW to be able to create lift. **When testing motors remove the props before plugging a battery in!**

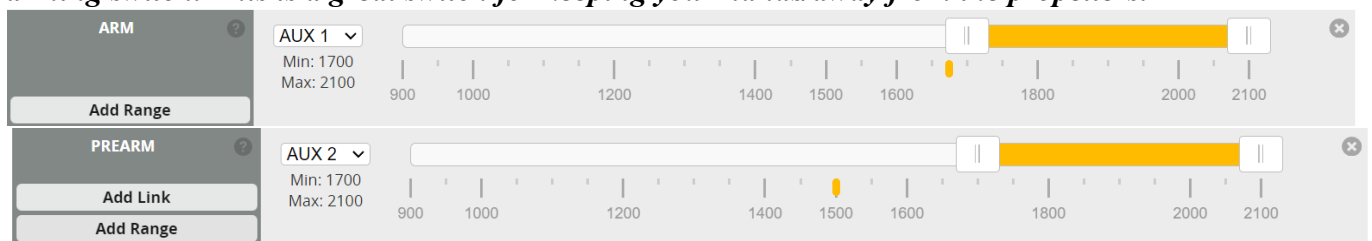
If your motors do not spin in the correct direction shown on the image, you have a few options:

- Click Reorder Motors, this will let you select the individual motors.
- Click Motor Direction to flip the direction.
- Physically unsolder, flip the end wires, and resolder the wires on the ESC.

### Setting Arming & Disarming Switches

Arming/Disarming Switch Should Be Set for you to be able to quickly and safely arm/disarm the quadcopter. Unlike GPS Drones, the motors will not disarm by default, you have to manually disarm each motor via a control switch.

***NOTE: Your transmitter may have different switch configurations. Many pilots fly with an additional pre-arm switch, which requires that a temporary switch be held down to enable the arming switch. This is a great switch for keeping your hands/away from the propellers.***





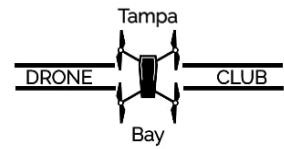
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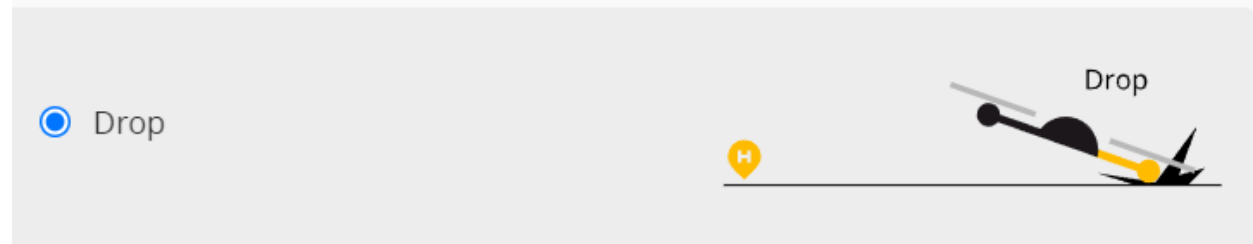
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### Setting Up Fail/Safe/Unsafe Conditions



Betaflight also has the options for some failsafe options, This means that if the RF signal is lost or interrupted, the quadcopter can RTH or land. We recommend that you set this to cut.

Cut means that if you lose control/RF signal lost, the quadcopter will disarm the motors, fall, and crash. **However, you will have no control, so dropping is the safest option in most situations.**



If you are planning to go long-range or overpopulated areas, consider installing a GPS and setting up RTH (Return-To-Home) or as it’s known “GPS Rescue.” Additional Parameters will need to be set PRIOR to flights on this tab.

☐ GPS Rescue

Maximum altitude ▾ Altitude mode

30 ▾ Return altitude (meters) - **only applies in Fixed Altitude mode**

7.5 ▾ Ascend rate (meters/second)

7.5 ▾ Return ground speed (meters/second)

45 ▾ Maximum pitch angle ?

20 ▾ Descent distance (meters)

1.5 ▾ Descend rate (meters/second) ?

1100 ▾ Throttle minimum

1700 ▾ Throttle maximum ?

1275 ▾ Throttle hover - **IMPORTANT: set this value accurately** ?

15 ▾ Minimum distance to home (meters) ?

8 ▾ Minimum satellites

☐ Allow arming without fix - **WARNING: No fix = disarm on failsafe!** ?

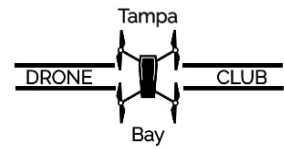
Failsafe only ▾ Sanity checks

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### **Learning More:**

Betaflight is an evolving open-source software platform. As such, the features will constantly change and update. Please visit their GitHub for updates and new feature releases:

<https://github.com/betaflight/betaflight>

### **Where To Purchase Parts?**

*Florida has 4 FPV Retailers that exclusively sell online.*

Online Only Retailers:

#### **Get FPV**

1060 Goodrich Ave,

Sarasota, FL 34236

(941) 444-0021

<https://www.getfpv.com/>

#### **Race Day Kwads**

1060 Goodrich Ave,

Sarasota, FL 34236

<https://www.racedayquads.com/>

#### **Rotor Riot**

4677 L B McLeod Rd

Suite J

Orlando, FL 32811

<https://rotorriot.com/>

In person stores:

#### **MyFPVStore**

2524 Palm Bay Rd NE

Unit #5,

Palm Bay, FL 32905

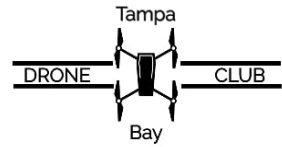
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### Preflight Checklist

This Checklist is to assist you in checking for preflight, during flight, and after flight operations.

#### *Pre Flight Check:*

- Balance Charge LIPO's No more than 24 hours prior to known flights. Use a Good Quality LIPO charger.
- Visually Inspect Aircraft For Damage Including Bent Props, Camera, RC Receiver, and video system.
- Visually inspect RC Transmitter for damage, including any broken/bent switches..

#### *When Arriving At Site:*

- Take note of any spectators, pilots, aircraft, or unforeseen hazards. Avoid large groups of people and fly cautiously.
- When flying with a group, ask about FPV channel assignments, and power level. **Do not plug in without ensuring all pilots are landed/in safe position.**
- Use a FAA Approved app, and request LAANC Clearance when needed.
- Function as a spotter when not flying for other pilots who are flying FPV. Announce hazards and keep an eye on wildlife, children, dogs, and other hazards.
- Avoid putting your goggles in the sun. use a cover to protect lenses from sunburn in.

#### *Post Flight / When packing up from site.*

- Before leaving site, do not leave your stuff behind!
- Cover your goggle lenses to protect them.
- Pack your stuff in your carrying case or bags, many FPV pilots use backpacks and easy to use totes.
- When you arrive home, and batteries cool, Put the battery's on LIPO storage charge, **DO NOT LEAVE ON DEAD VOLTAGE.**
- Remove any batteries from devices including transmitter and store in a LIPO safe bag.

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