THE UNIVERSITY OF ARIZONA

Women in Engineering
Summer Engineering Academy Day

Drone Building Project

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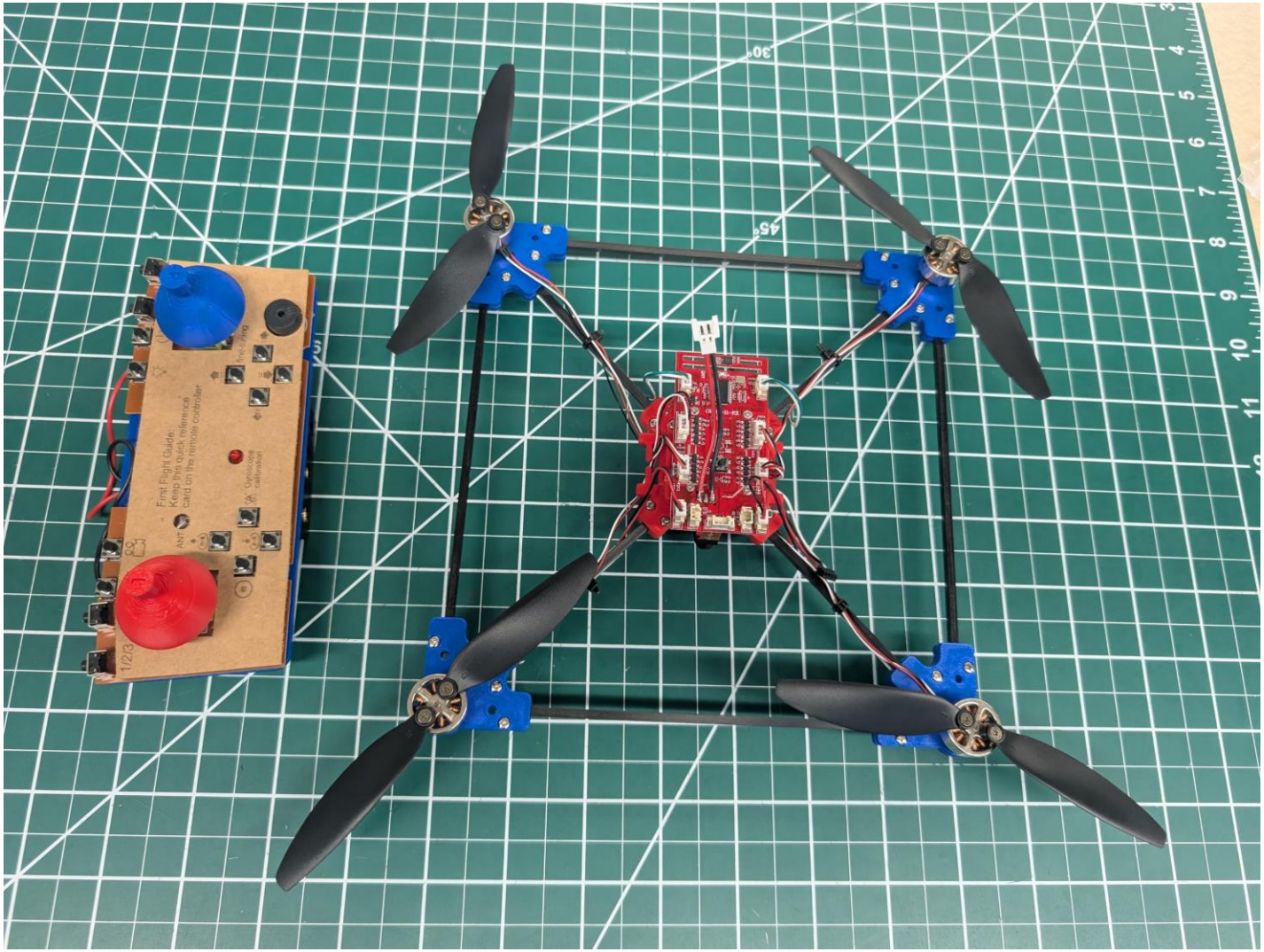
The Vegetation Index and Phenology Lab (vip.arizona.edu)

Biosystems Engineering

Vegetation Index & Phenology Lab.

...Understanding a piece of the Earth system

We are going to build a drone



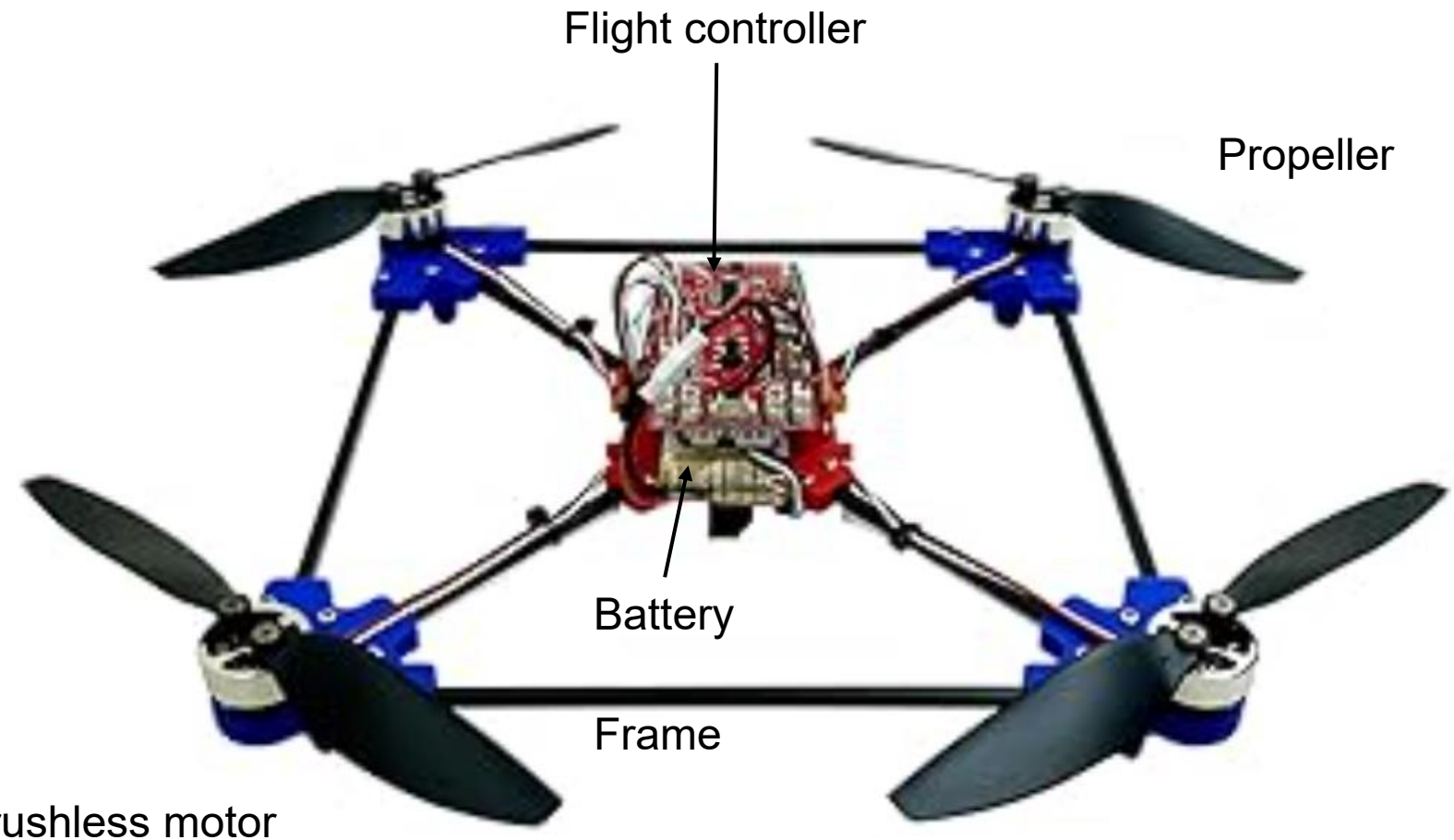
Rules

- Small drone, no registry to FAA required
  - All drones must be registered, except those that weigh 0.55 pounds or less (less than 250 grams)
- We are not going flying a drone today
  - You need permission from the University of Arizona
- You need a pilot license
  - Similar to actual pilots of commercial planes

Learning objectives

- We are going to learn together!
- Drone basics
- Drone parts
- Assembly process
- **Rules and security: trust but verify!**
- We teach a class BE385 – Precision observation with drones

Drone parts


Flight controller
Propeller
Battery
Frame
Brushless motor

What are Drones?

- Name derived from Honeybee "**Drones**"
  - Male bees with one 'mindless job' under the (supposedly) 'control' of a faraway "Queen"
- Hence Autonomous/Autopilot vehicles
- Under the control of the pilot/computer with manual intervention when needed

Naming convention

- Unmanned Aerial Vehicles (UAVs)
- Unmanned Aerial Systems (UASs) – FAA
- Multirotor, Quadcopter, Quadrotor, **Drones**, etc. (Layman convention)

Unmanned Aerial Vehicle

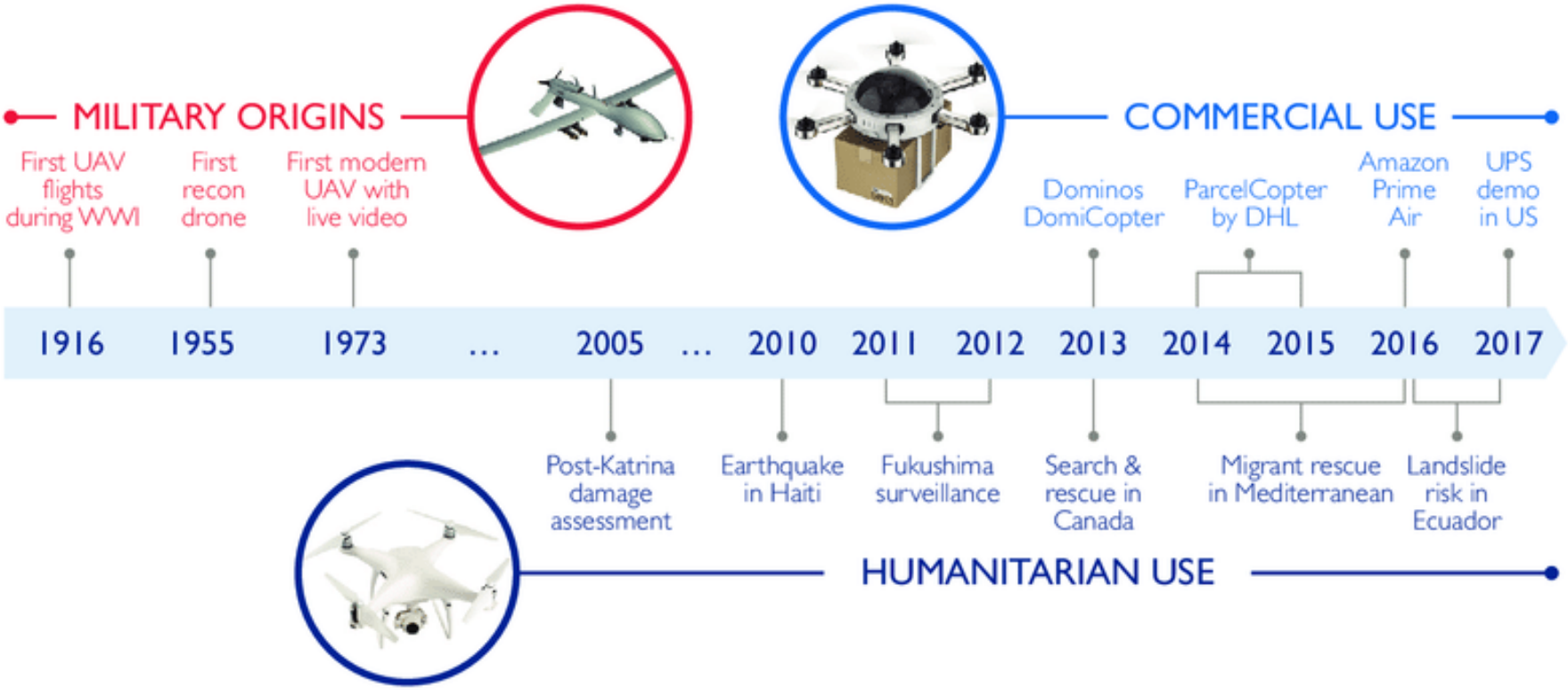
First Person View

Unmanned Aerial System

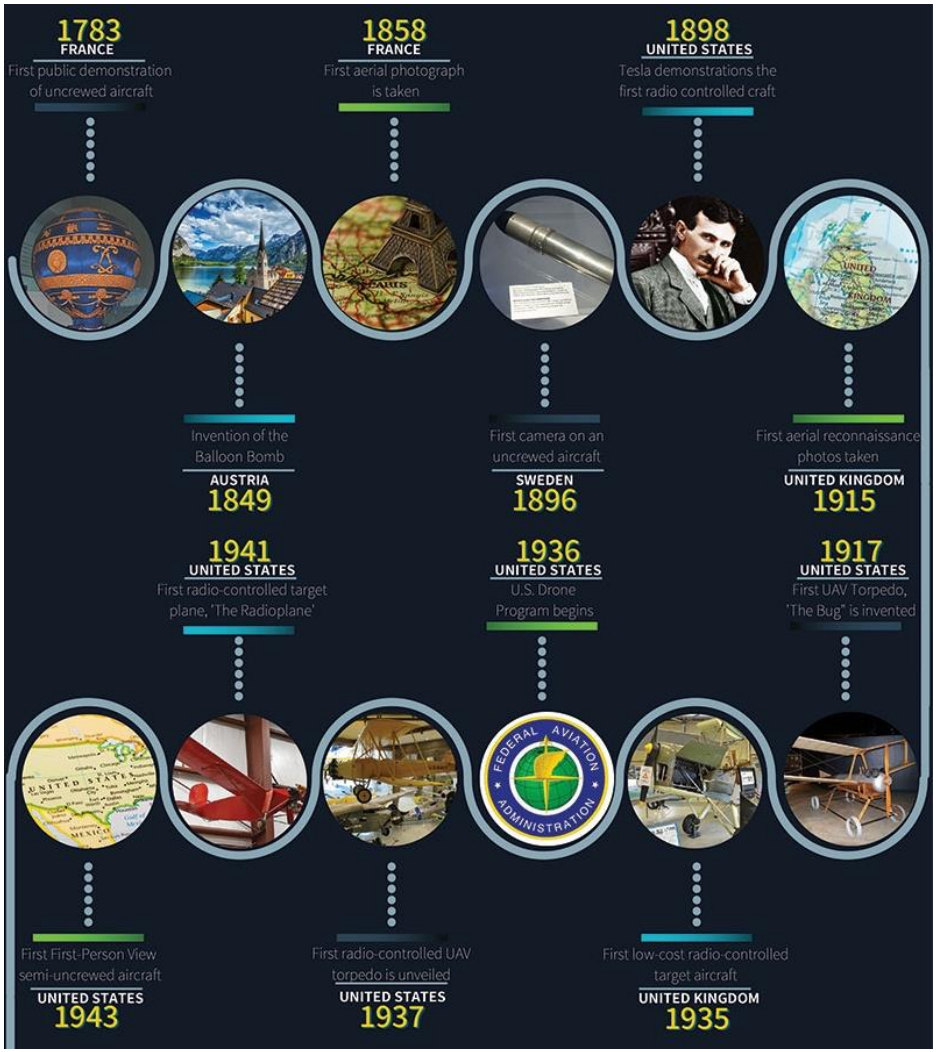
Humming sound of bees, Male bee = Drone

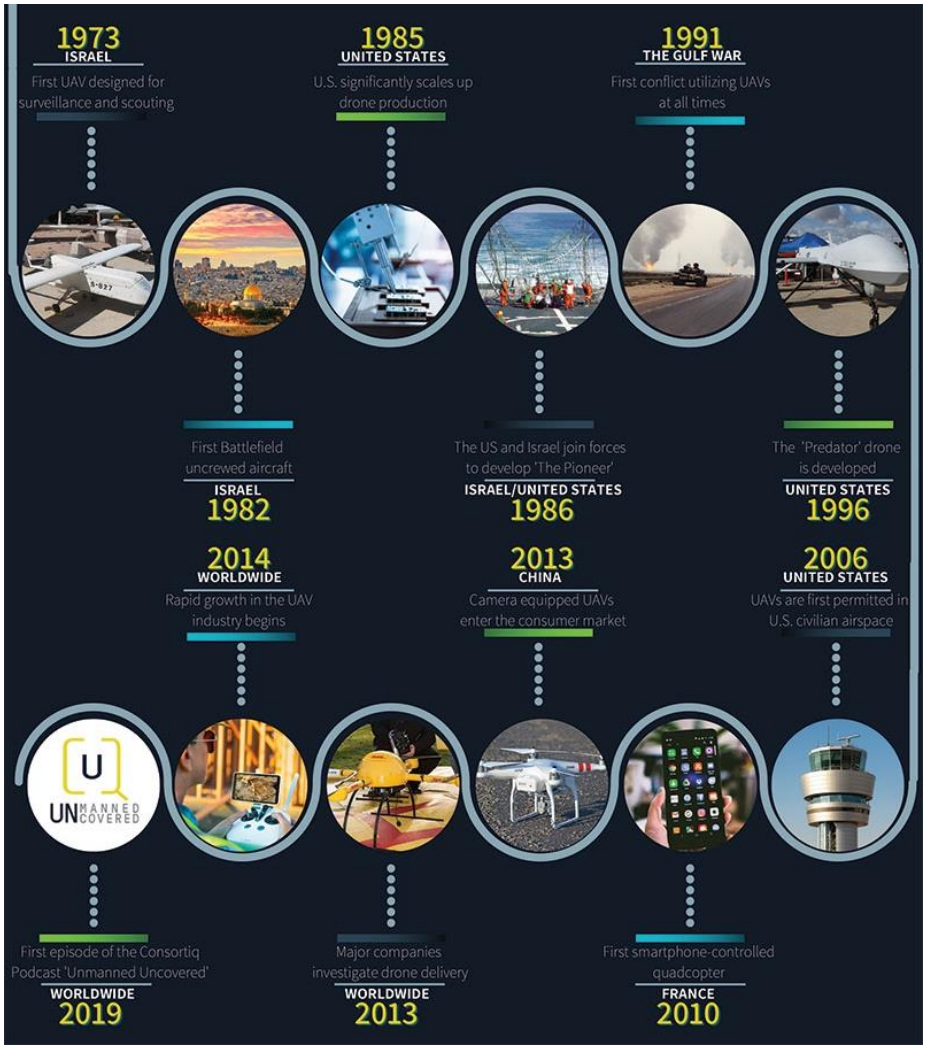
Remote Pilot Aircraft

Origin of drones

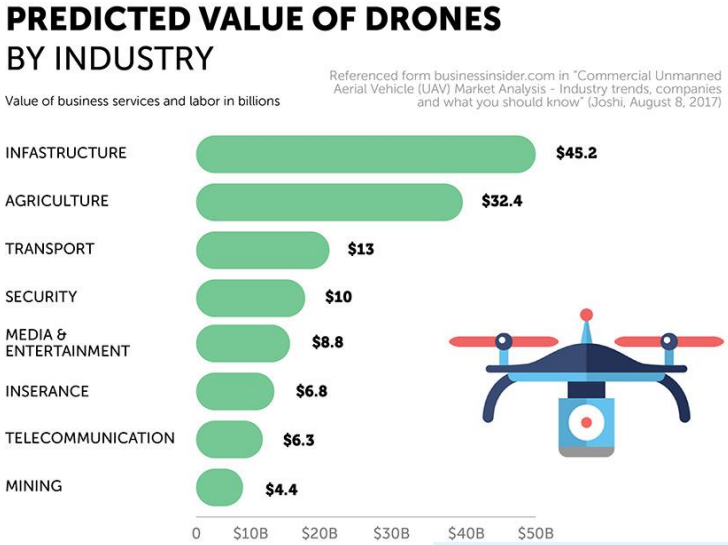


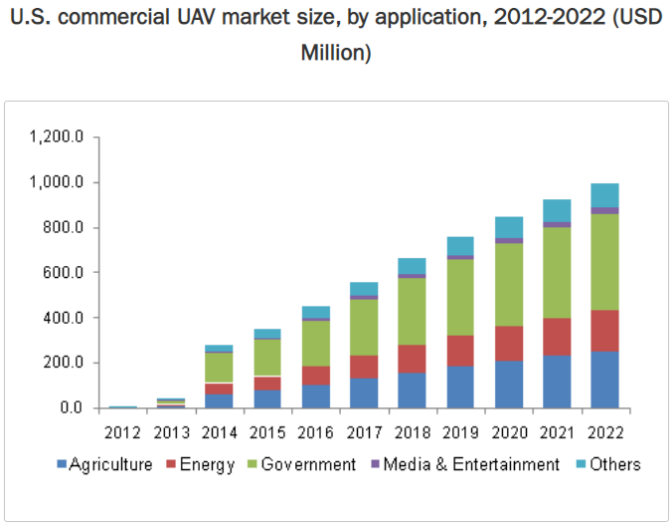
Formal (academic) history

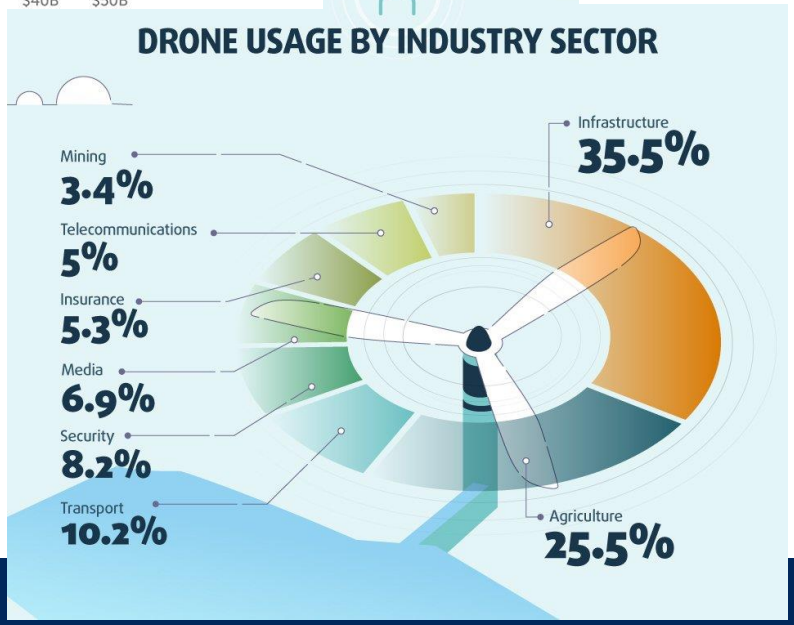




Usage by Sector

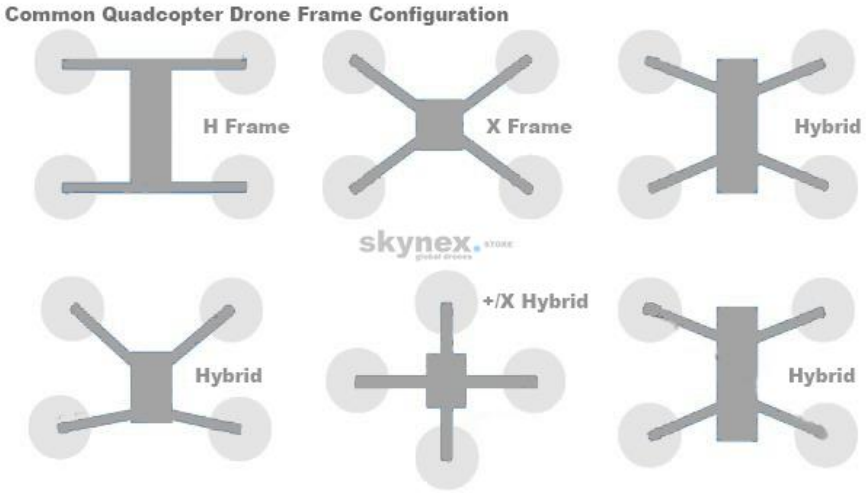


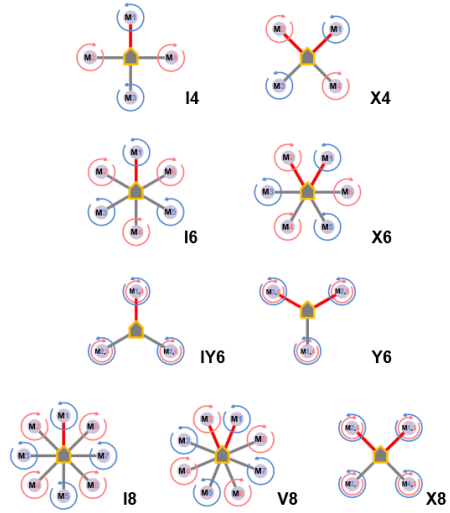


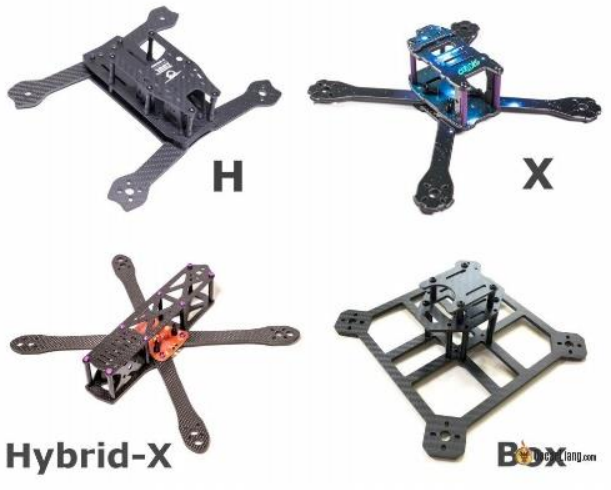


3 basic frame shapes

- PLUS (+)
- X
  - Stretched X and True X
- H Frame
  - Aerodynamic considerations
  - Payload
  - Size
  - Taste

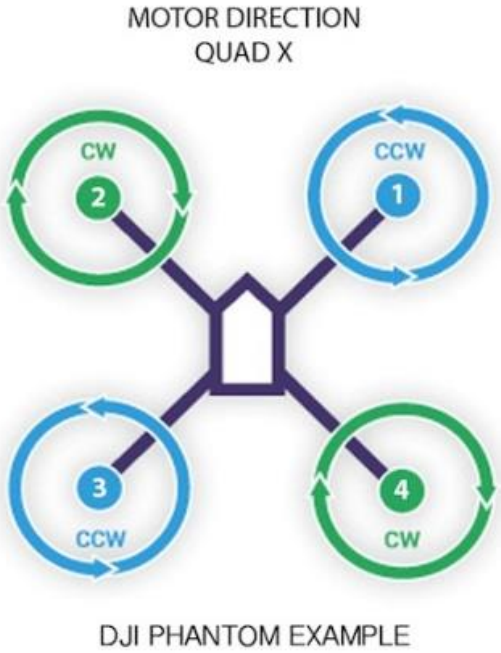


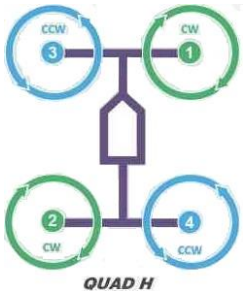


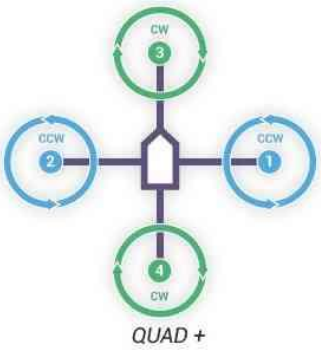


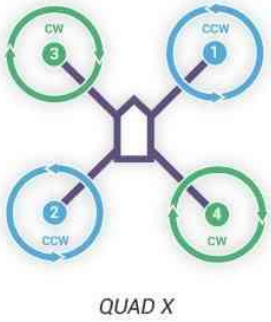
Motor order

- Convention used to help setup the drone and couple it with the Flight Controller (FC)
- Different FCs require different order/sequence (always check FC specs)

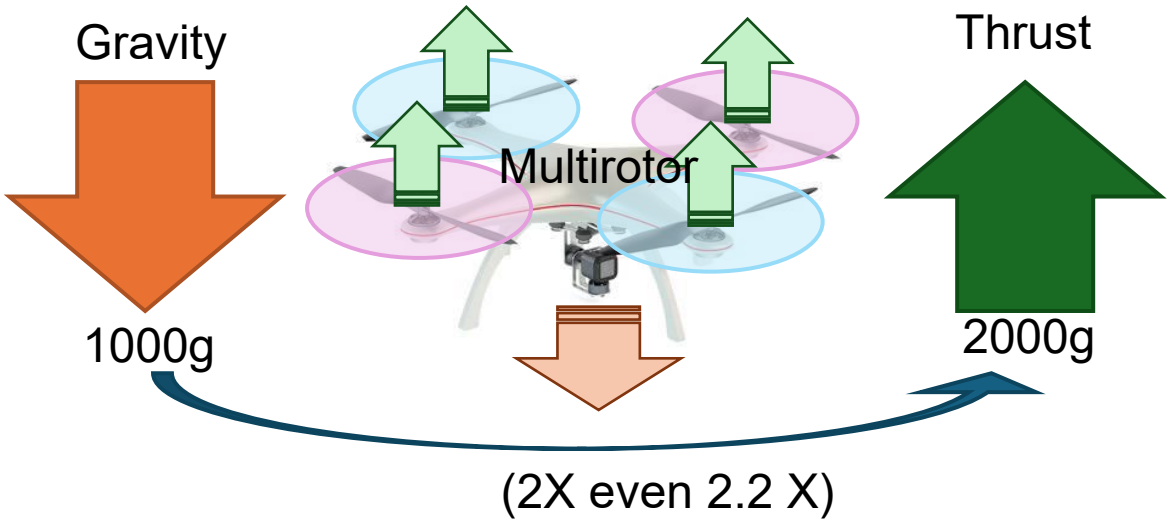






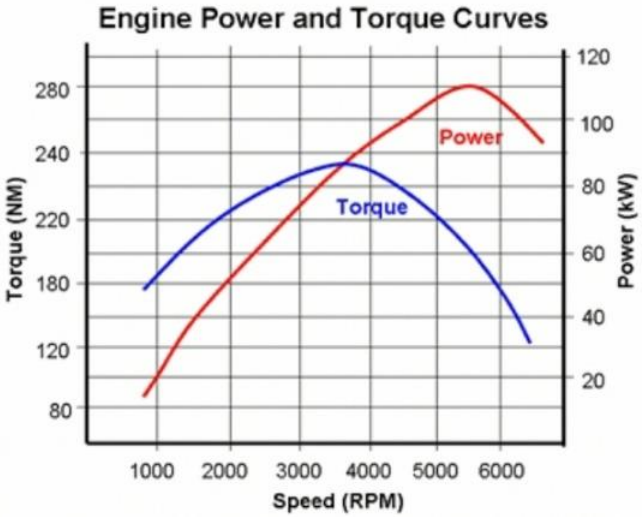


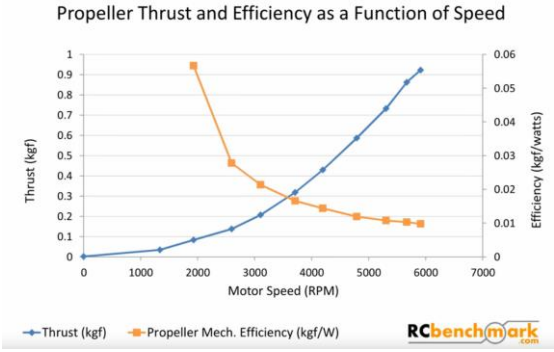
Flying principle



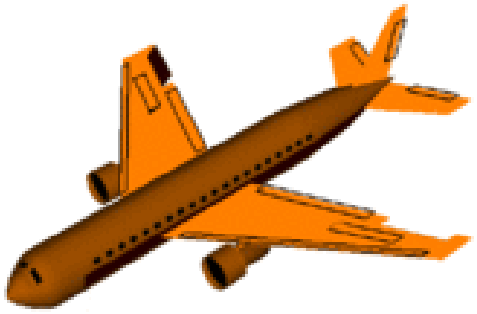
Thrust measurement

Motor + Propeller + Battery

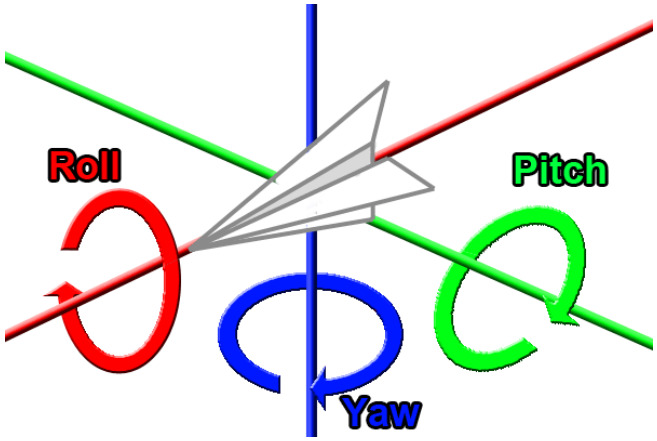


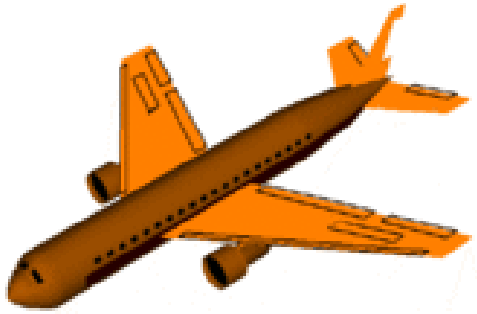


Orientation

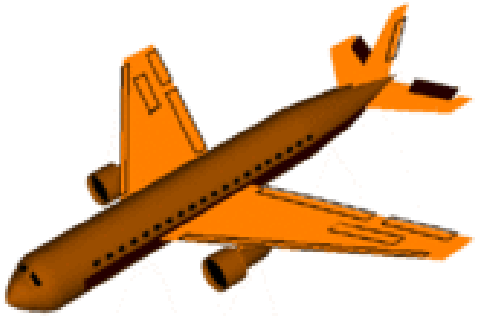


ROLL



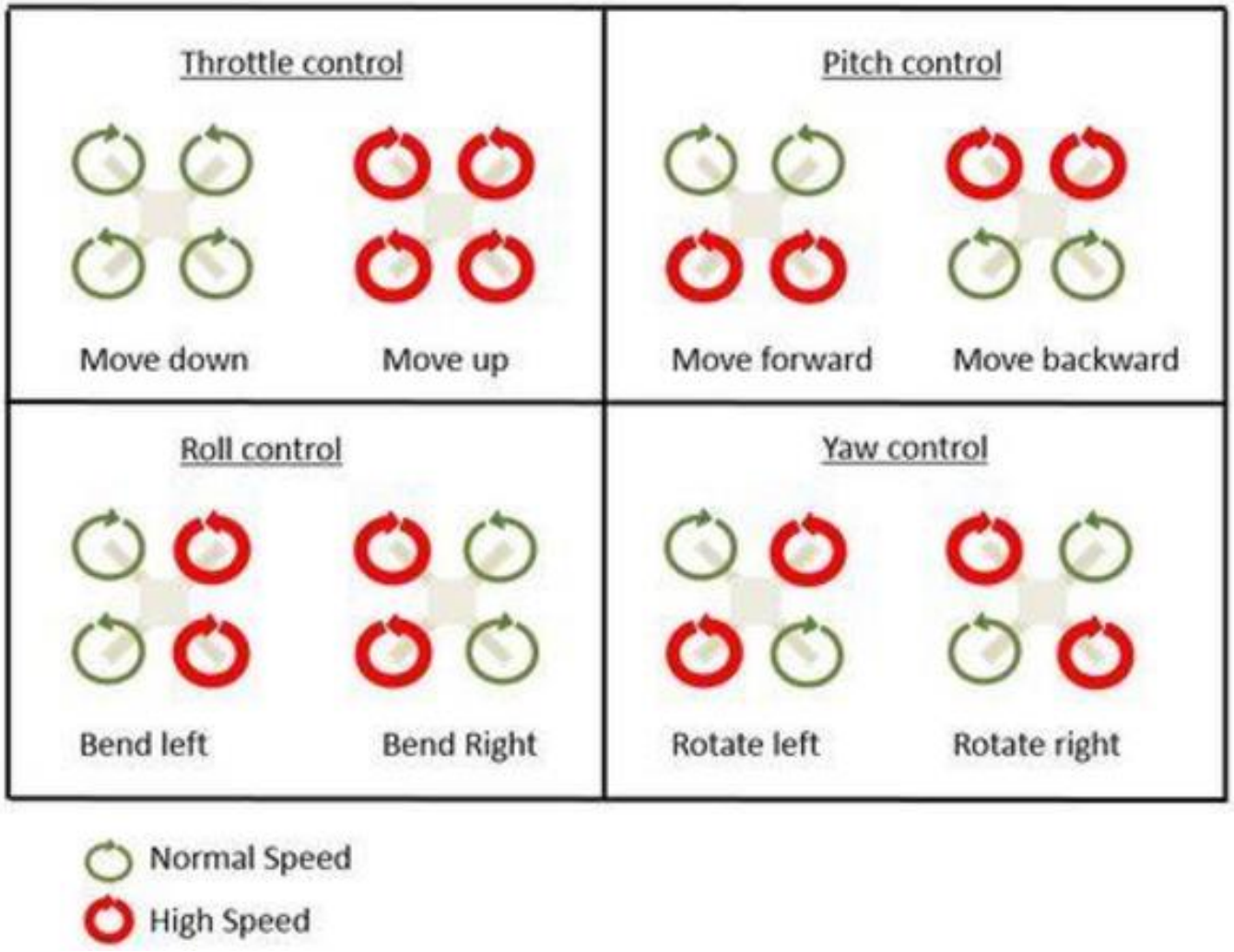


YAW

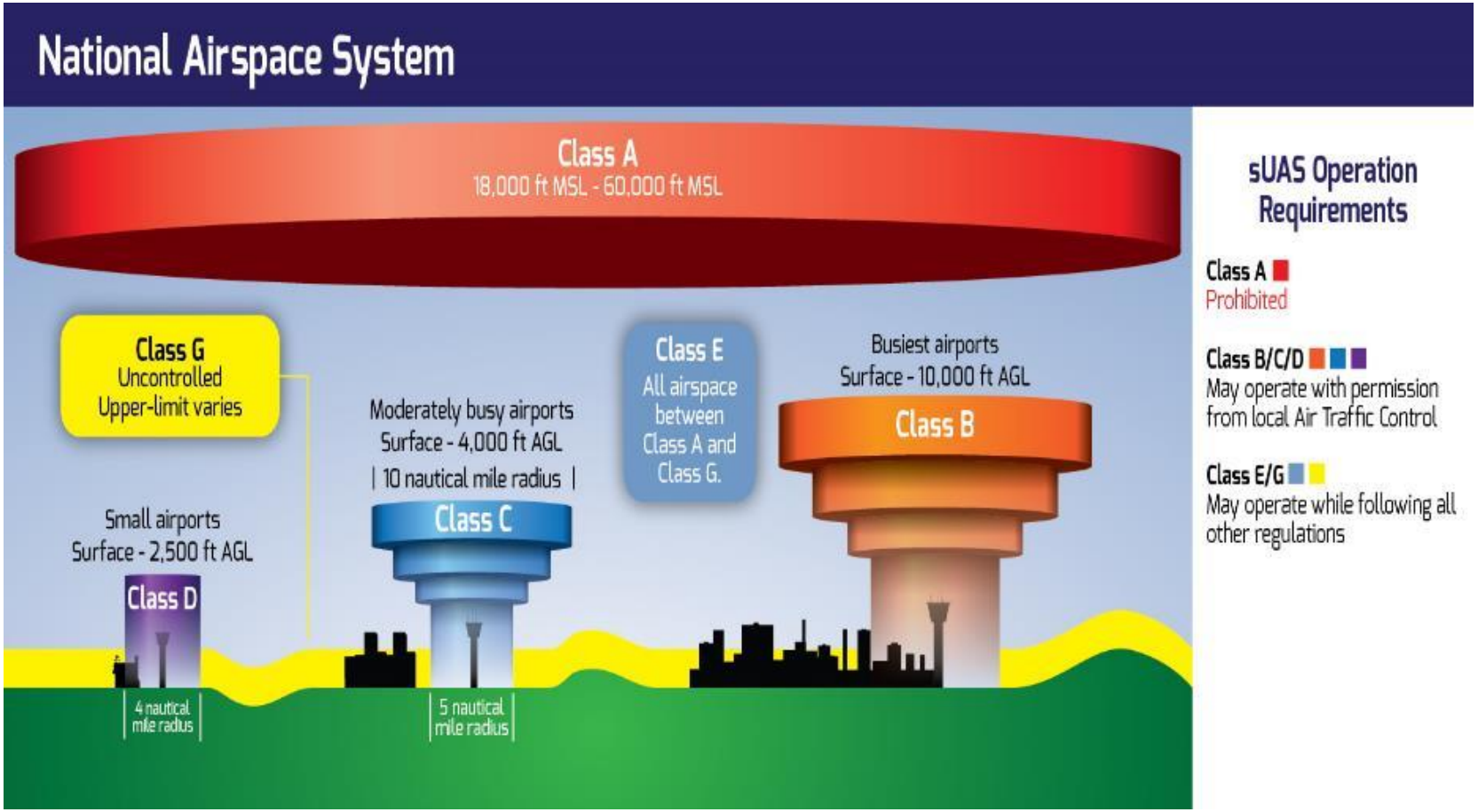


PITCH

Quadcopter Flight Patterns



Flight restrictions



Drone kit

Frame

Flight controller

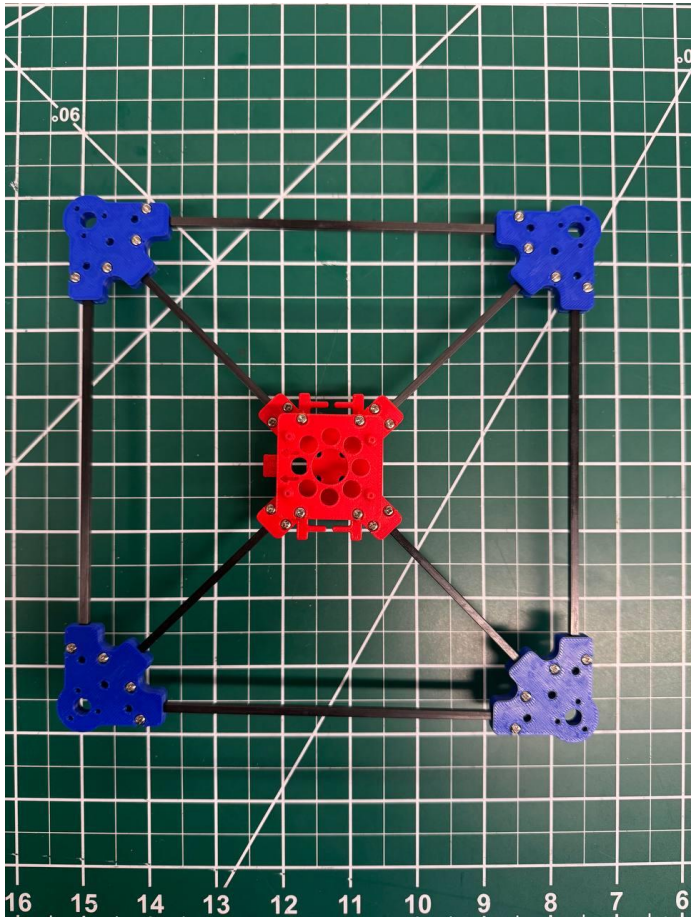
Propellers

WiFi video transmission

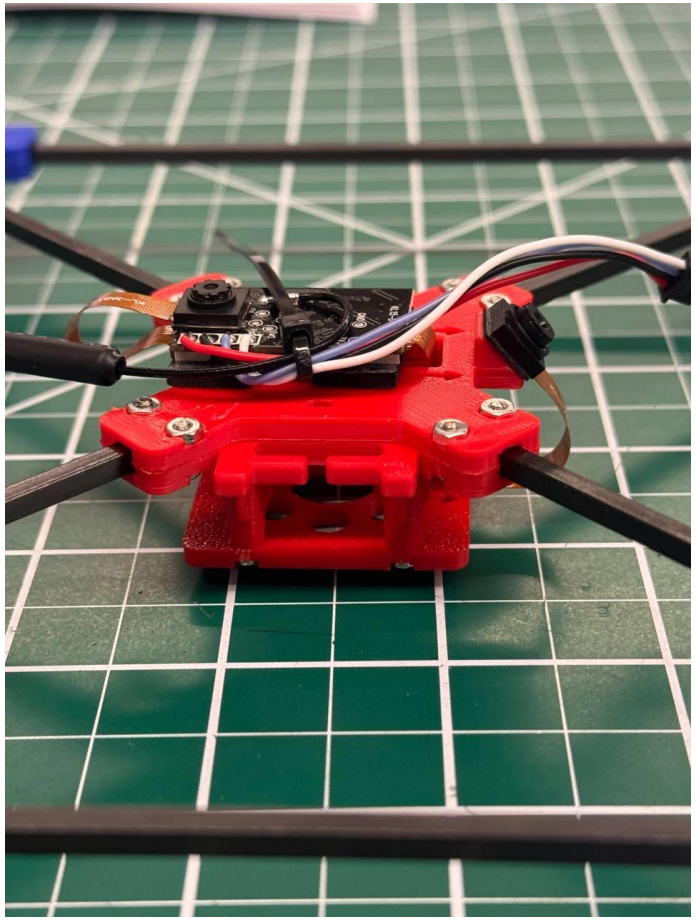
Brushless Motors

Battery

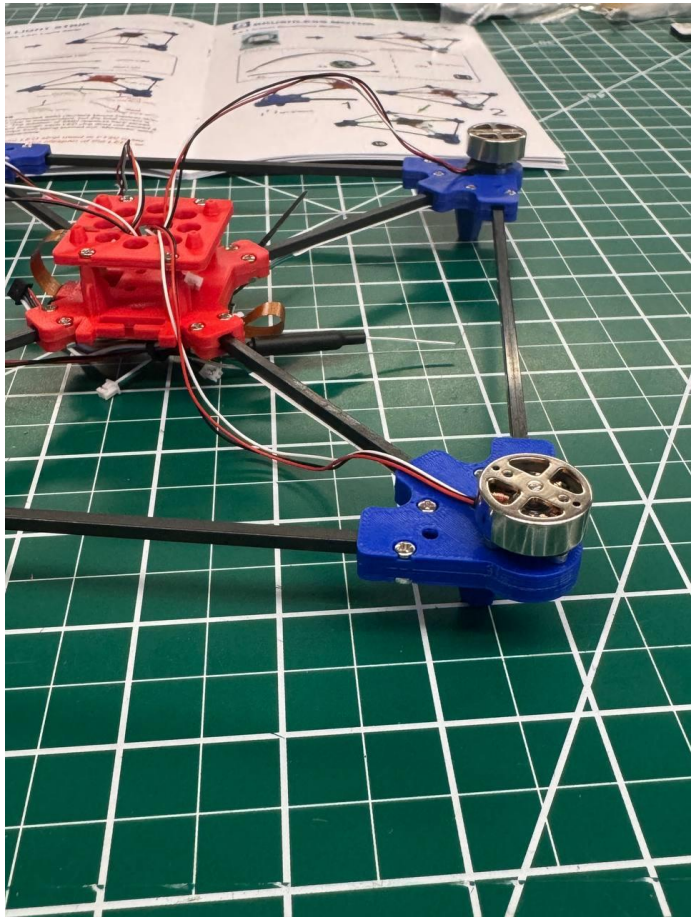
Frame



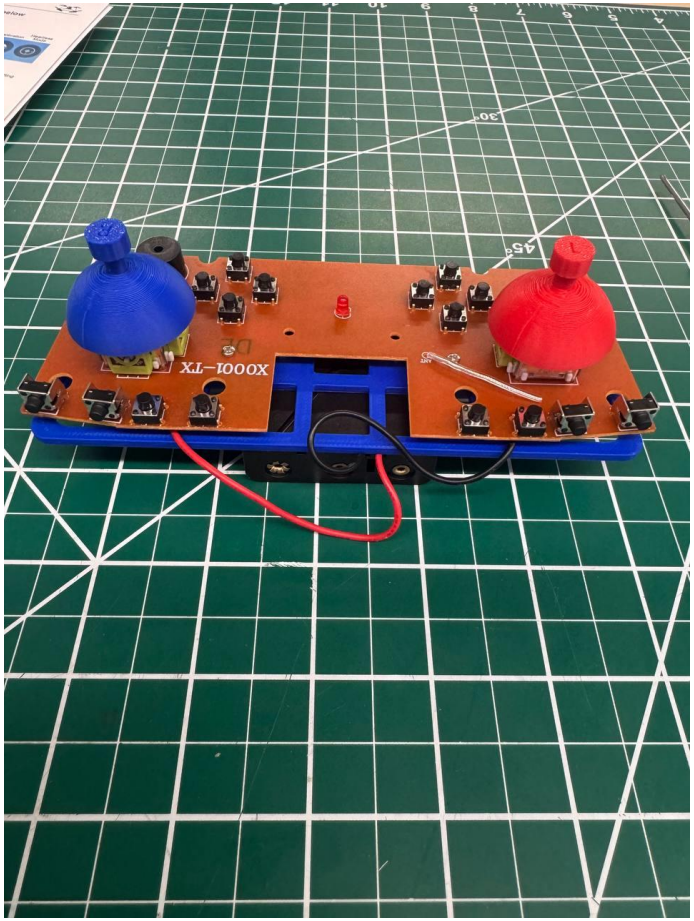
Cameras

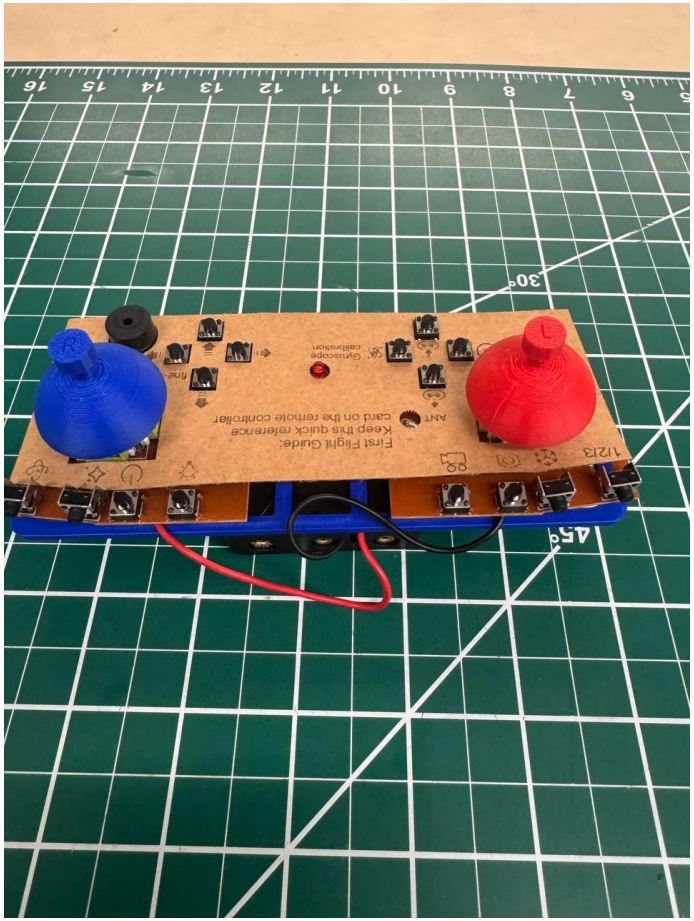


Motors



Build the radio controller





Security

- If successful we will test inside the cages
- Wear goggles or face shields
- Please be careful of things that can be in the way of propellers, like **long hair, scarfs, necklaces**, etc.
- We will test the drone inside the cage
- Call us when you are ready

Now is your turn to try!