







Drone:

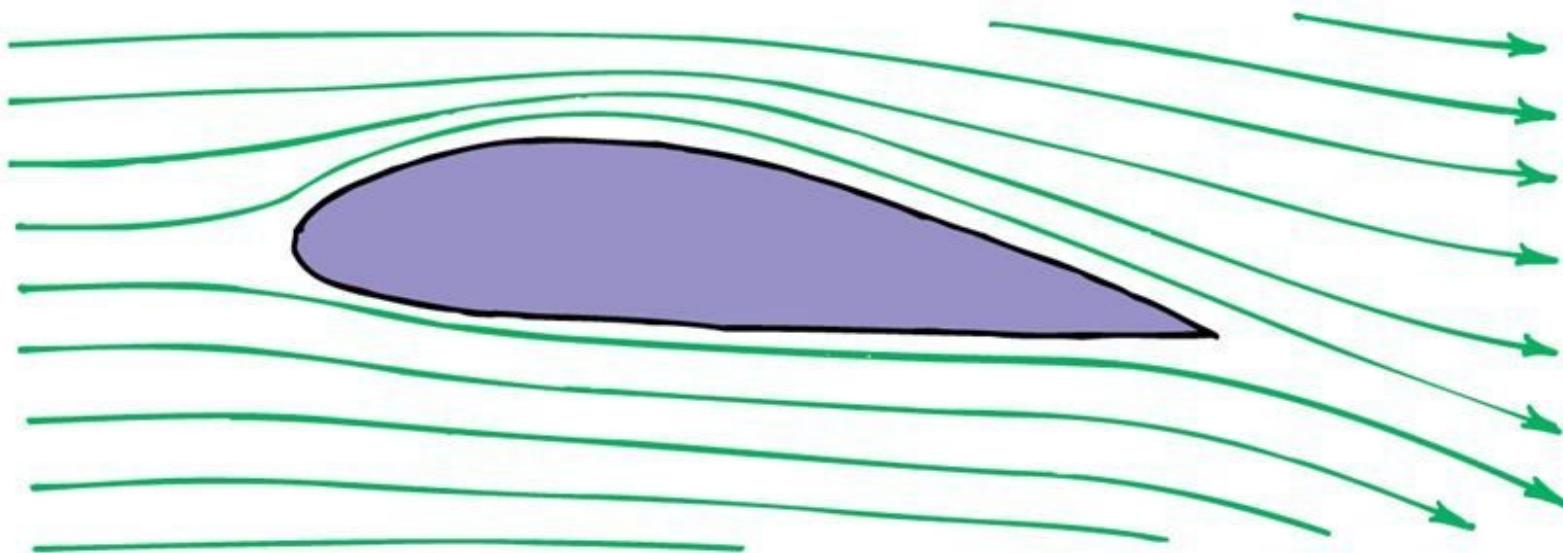


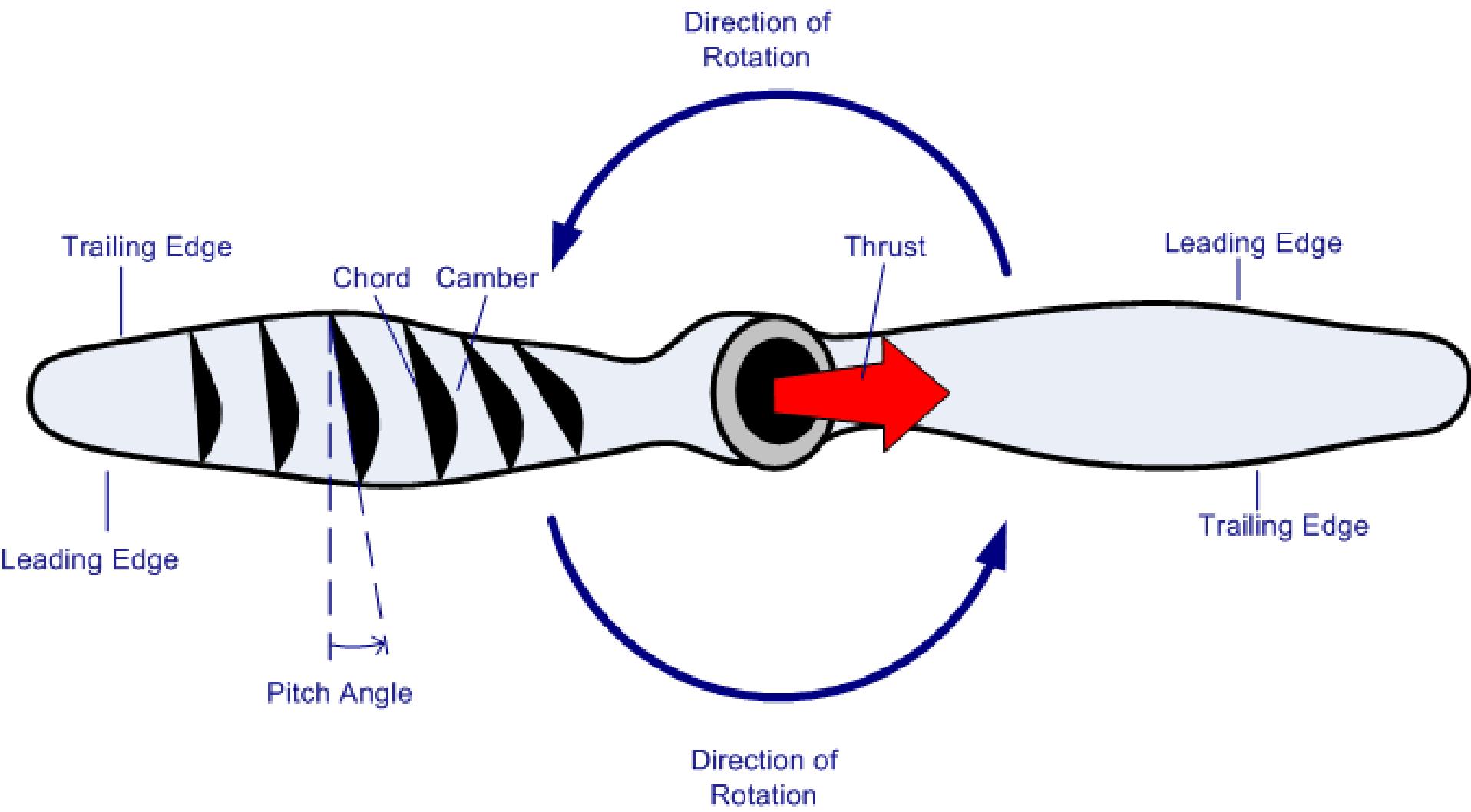
- du mot anglais signifiant "faux bourdon"
- aéronef sans-pilote
  - donc sans humain à bord
  - le plus souvent télécommandé
- usages militaires, civils et de loisir



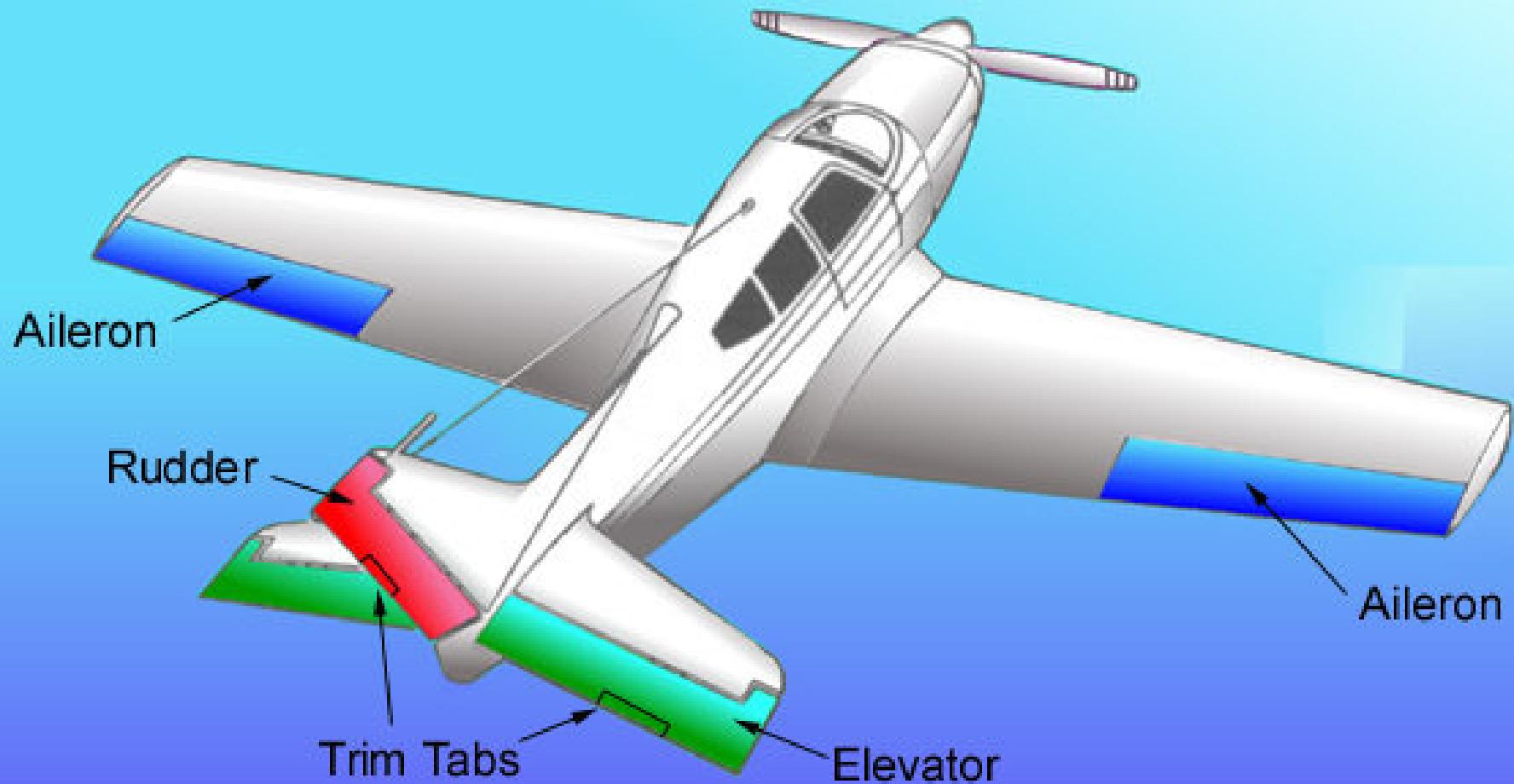
# Application of Bernoulli's Principle: Shape of the wings

- Air pressure above the wing is .....  
the pressure below the wing.





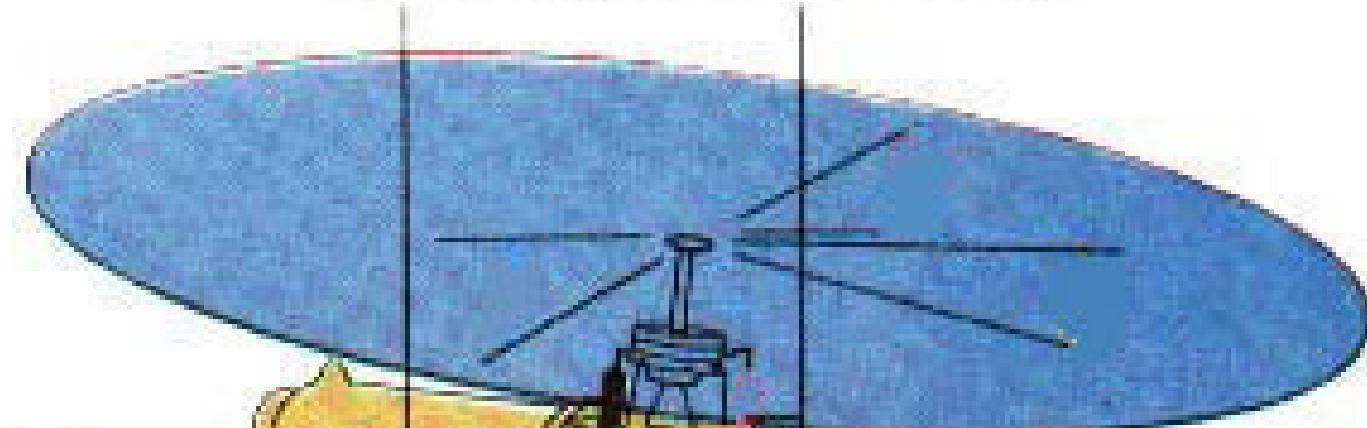
## Move Mouse Over Flight Controls



**Control heading**



**Control attitude and altitude**



**Collective**

**Cyclic control stick**

**Tail rotor control pedals**



# Maneuvering

Throttle control		Pitch control	
			
			
Move down		Move up	
Roll control		Yaw control	
			
			
Bend left		Bend Right	
Rotate left		Rotate right	

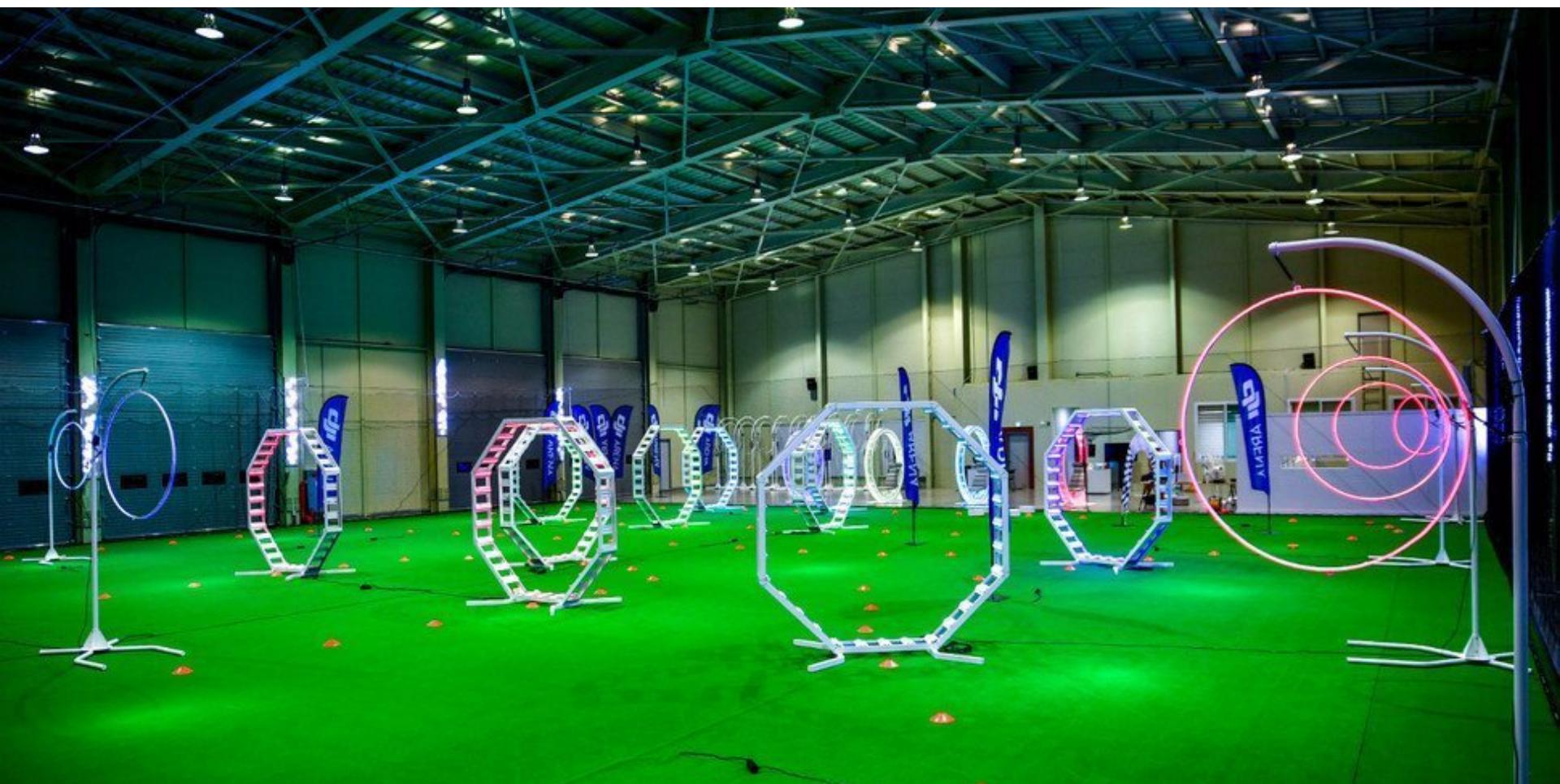
 Normal Speed

 High Speed

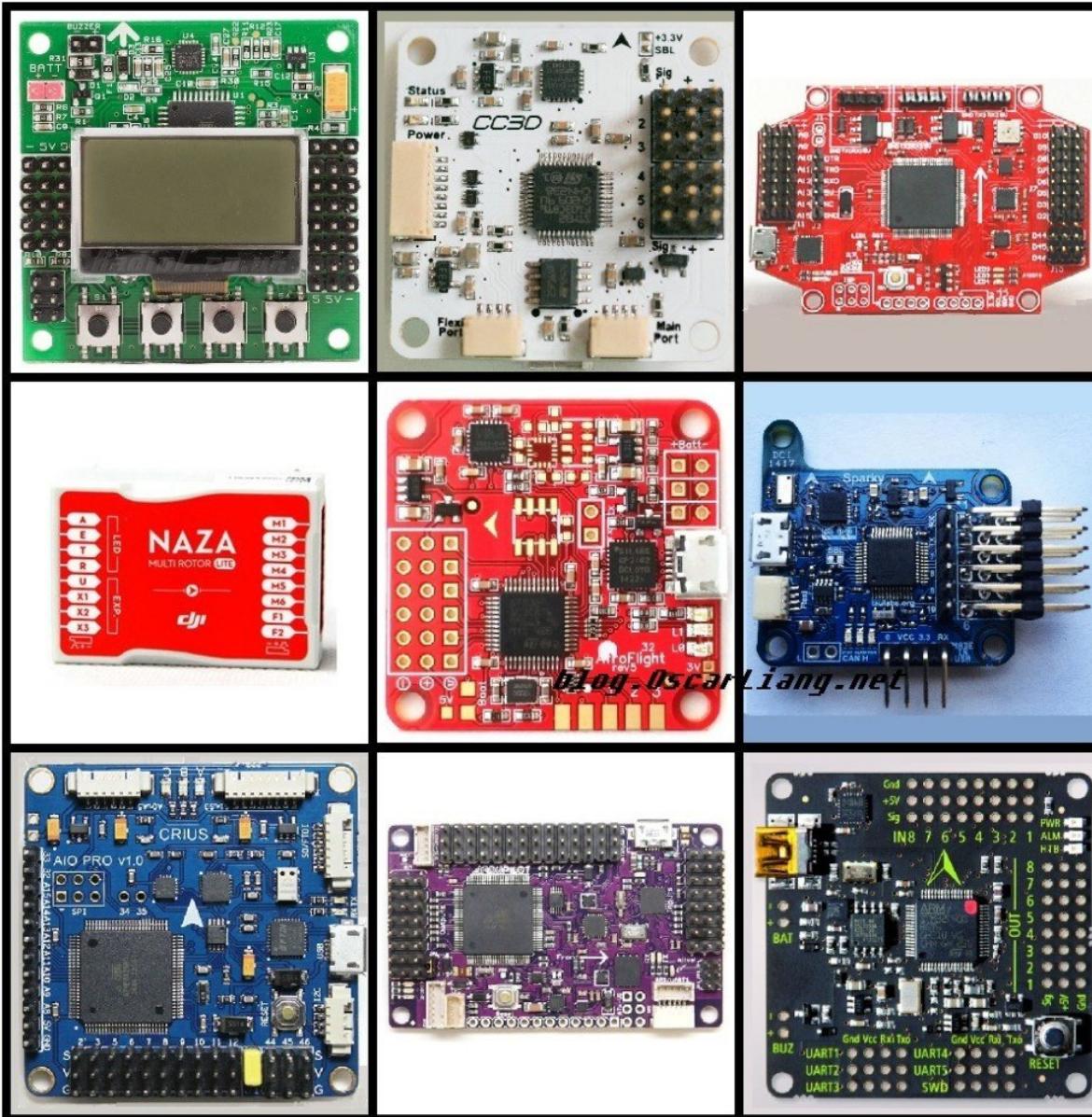








# Flight Controller



# Sensors

- 3 axis accelerometer
  - linear acceleration in 3 axes.
- 3-axis gyroscope
  - angular acceleration in 3 axes
- Magnetometer
  - magnetic compass
    - 1 to 3 axes
- Barometer (pressure sensor)
  - altitude
- GPS
- Distance Sensor
  - ultrasonic
  - laser based
  - LIDAR based

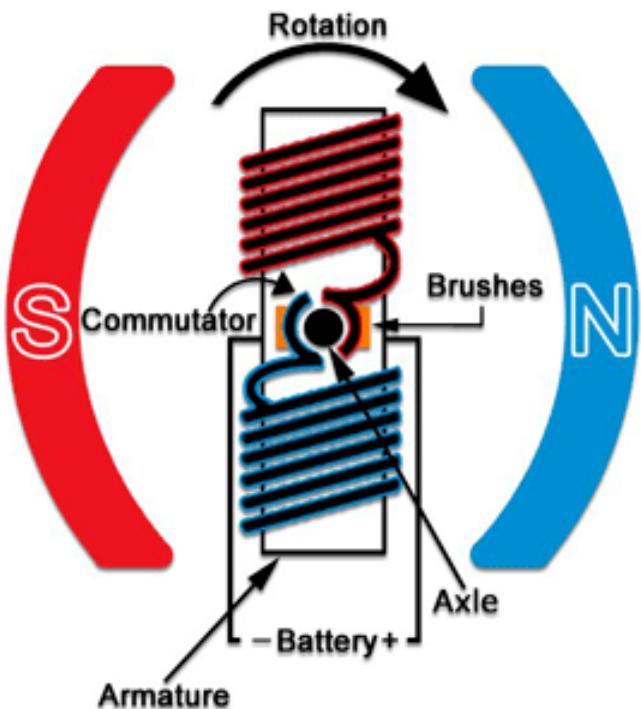
# Electronic Speed Controller



# Drone Motor

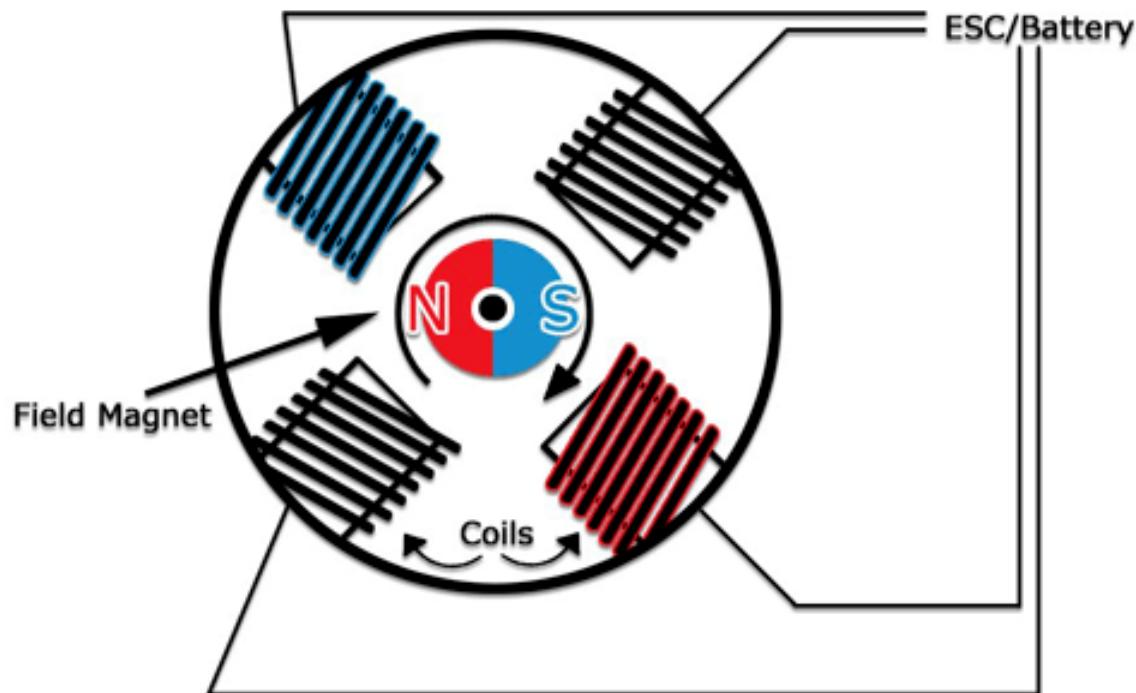


Brushed DC Motor

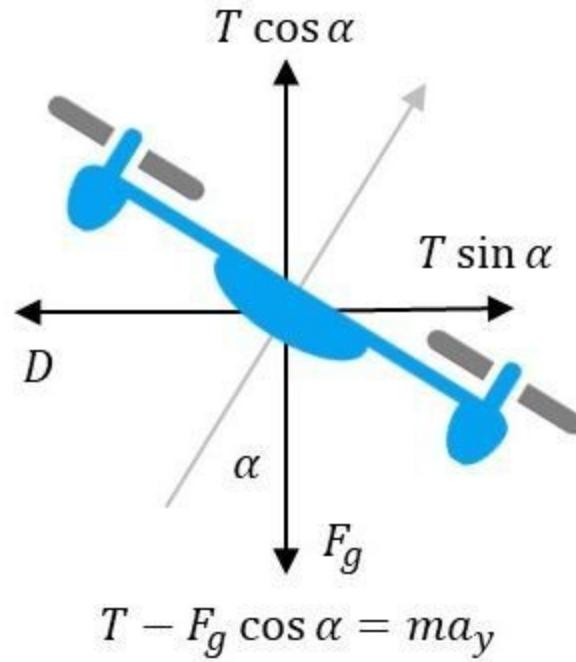
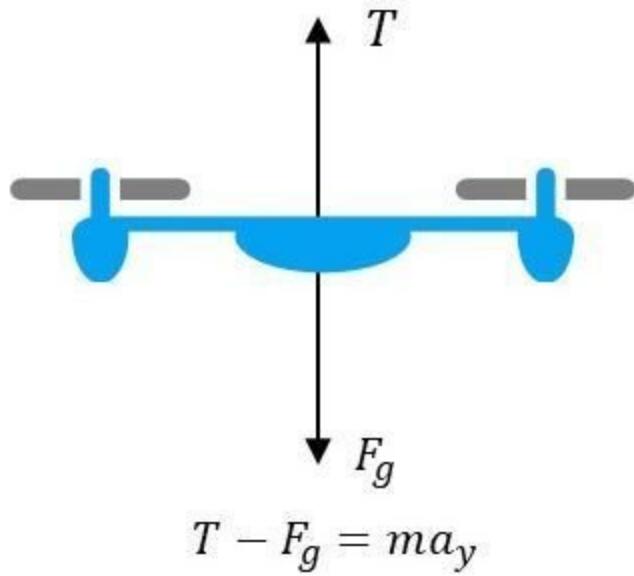


VS

Brushless DC Motor



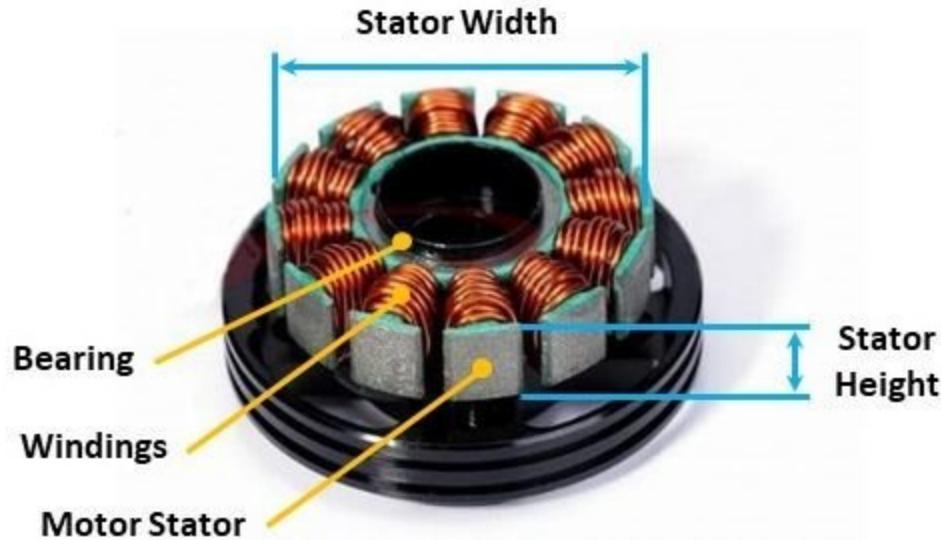
- total weight
- frame size



A general rule of thumb is that the drone motors should be able to provide twice as much thrust as the weight of the drone

# Motor Size

- 4-digit number of the pattern XXYY
  - the XX represents the motor stator width
  - the YY represents the motor stator height.
- Both dimensions are in millimeters



## kV specification

- number of revolutions per minute that the motor will turn when one volt is applied with no load on the motor
- when you attach a propeller, you will get a reduction in the number of RPMs due to added inertia of the propeller, and air resistance
  - higher kV motors will spin the propeller faster (racers)
    - smaller propeller
  - lower kV motors will generate higher torque (heavy loads)
    - larger propeller
- Examples:
  - 2600 kV and higher motors for 4" propellers
  - 2300-2600 kV for 5" propellers
  - 2300 kV and lower for 6" propellers

Number of LiPO Cells	Nominal Battery Voltage	Common Quadcopter Applications
1S	3.7V	Indoor micro brushed (e.g. Tiny Whoops)
2S	7.4V	30-70mm micro brushless
3S	11.1V	100-220mm brushless
4S	14.8V	220mm brushless race/freestyle
5S	18.5V	220mm+ brushless race/freestyle/ quadcopters
6S	22.2V	220mm+ brushless

C-Rating:

Maximum Safe Current Draw (mA) =  
 Battery Capacity (mAh) \* C-Rating



40A per motor !

Name	Image	Recommended Cells	Common Quadcopter Applications
JST-PH		1S	Micro brushed
JST-XH		1S	Micro brushed
JST		2S-3S	Micro brushless
XT30		3S-4S with capacities less than 800mAh	100-150mm brushless
XT60		3S-6S	220mm brushless
XT90		4S-6S	300mm+ brushless
EC3		2S-4S	250mm brushless (less commonly used than the XT60)
Deans		2S-4S	250mm brushless (less commonly used than the XT60)

# WFT06X-A Transmitter Features (Front)



## Mode 1



## Mode 2



## Mode 3



## Mode 4







The 2.4GHz system is the standard for radio control

- protocols for frequency hopping
- they basically look for available channel automatically
  - to avoid interfering with other pilots
  - allowing multiple pilots flying at the same time
- smaller antenna which
  - much more portable
  - range is shorter than the lower frequencies

2.4 - 2.454 Mhz: max 100 mW

5.800 Mhz: max 25 mW

[www.mcchaufour.be](http://www.mcchaufour.be)

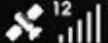








F-GPS



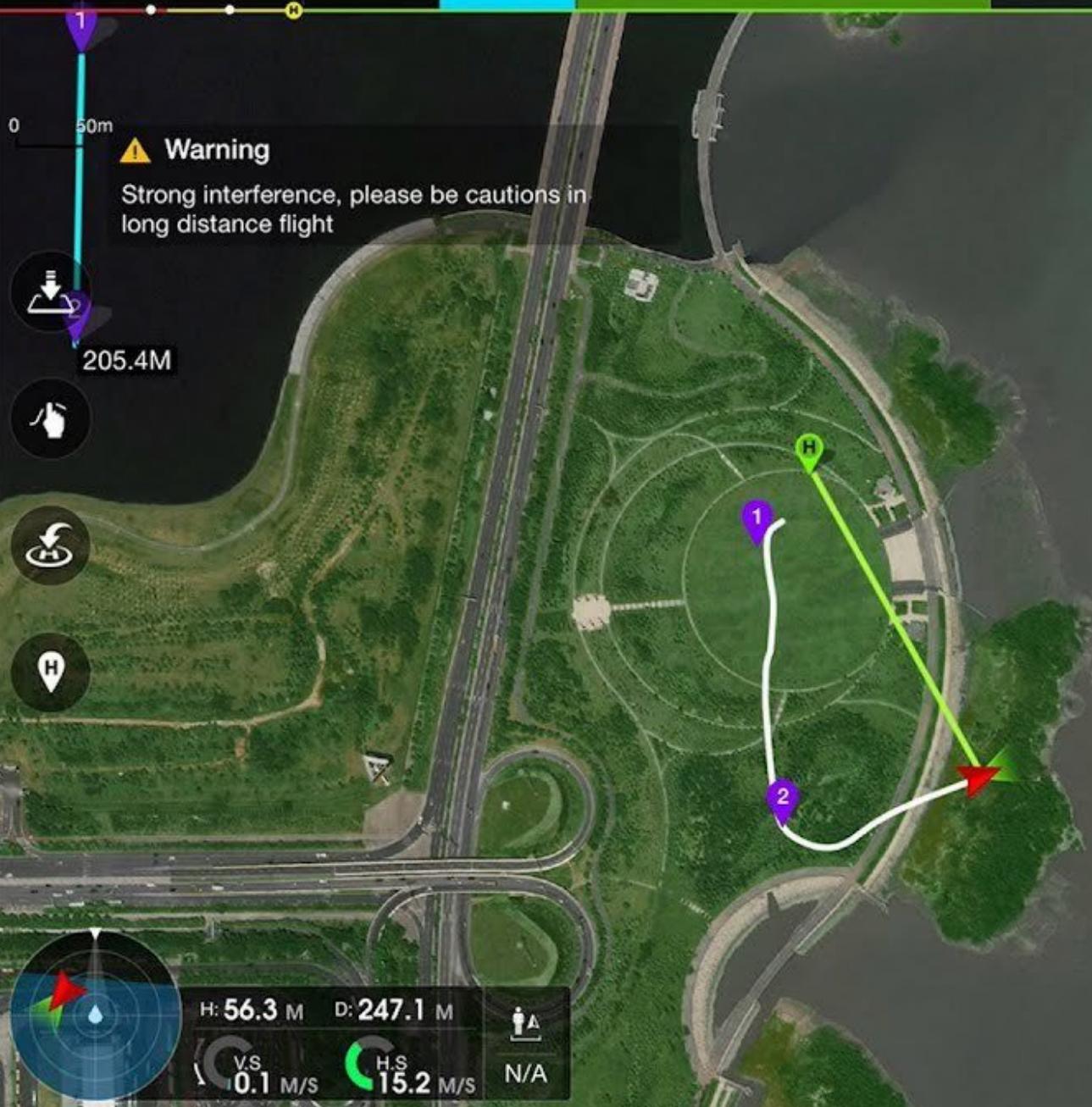
Safe to fly (GPS)



91%



16:31



No. of waypoints

2

Total Distance

205M

(Max radius:  
500m, Max path  
length: 5000m)

Delete (C2)

Record (C1)

Done



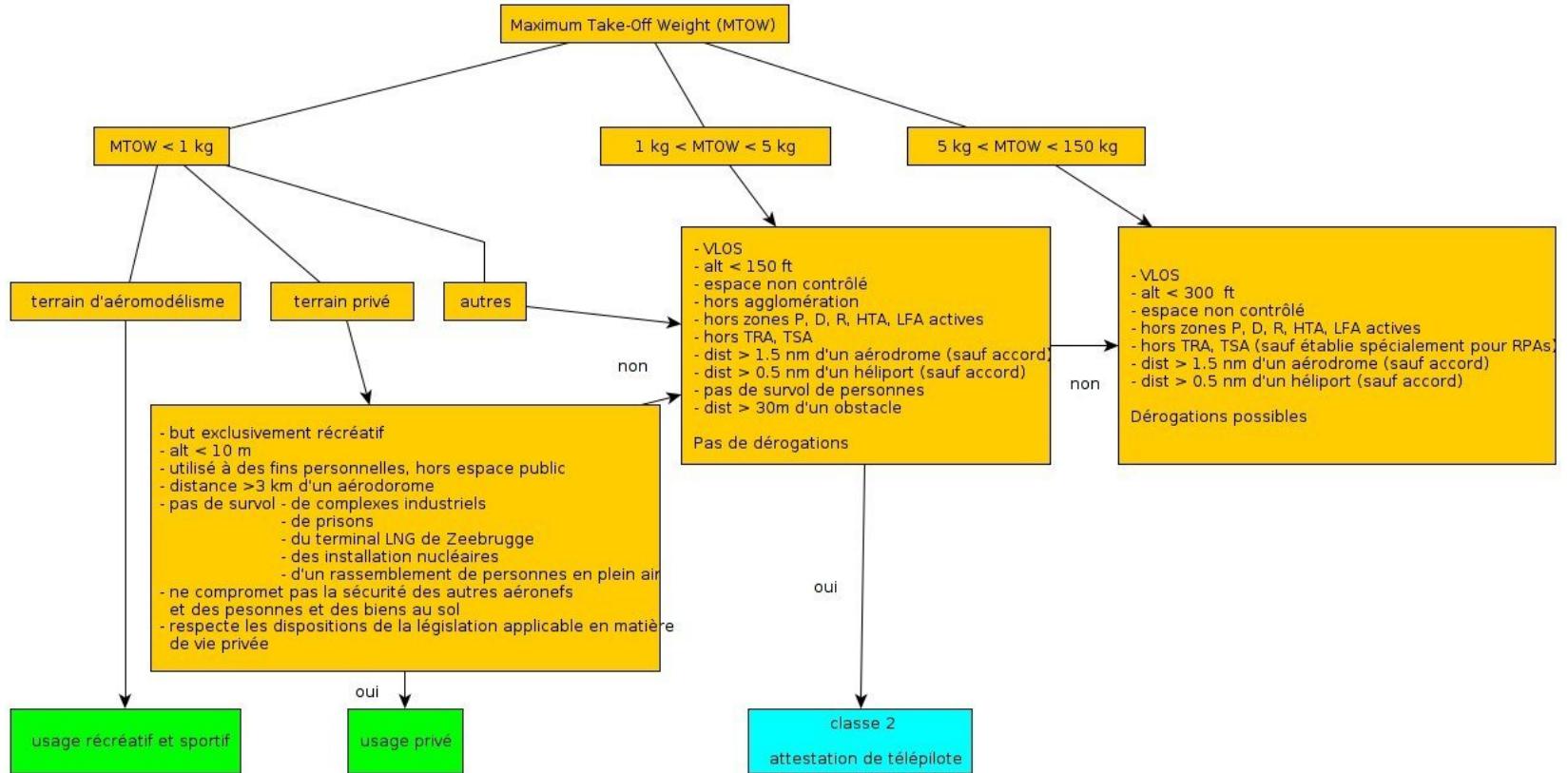
## Limitations

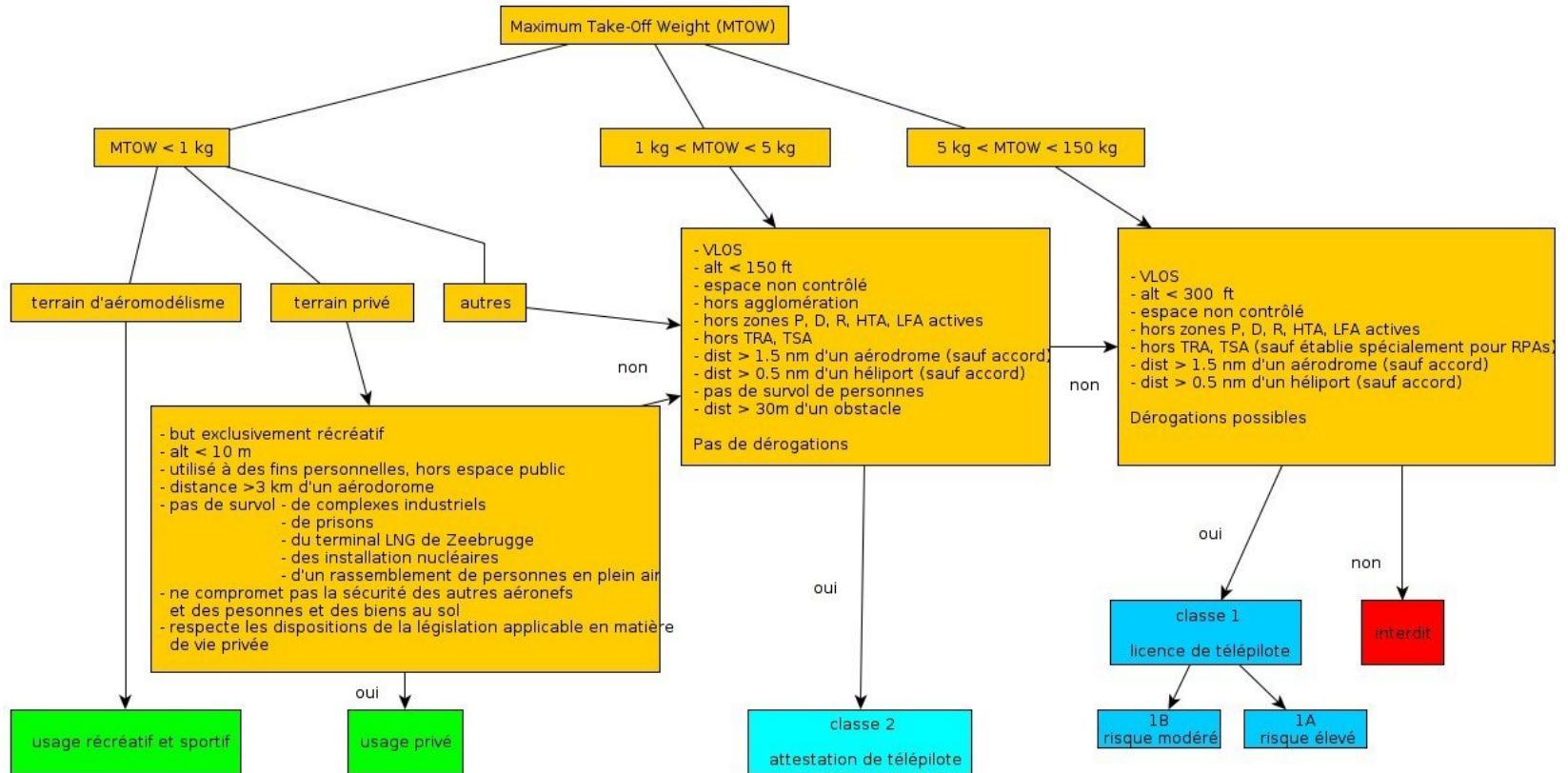
- vent
- temperature
- index K



## Attestation de télépilote:

- 16 ans
- formation théorique
  - réglementation aéronautique
  - météorologie
  - navigation
  - cadre légal relatif à la protection de la vie privée et au traitement des données à caractère personnel
- examen pratique
- valable à vie





## Licence télépilote d'un RPA ou drone:

- 18 ans
- Formation théorique
  - Réglementation de l'aviation et procédures ATC
  - Performances humaines et limitations
  - Météorologie
  - Communication
- L'examen se déroule sur ordinateur et comprend au minimum 50 questions à choix multiple
  - Pour réussir, vous devez atteindre au moins 75% pour chacune des 4 matières
- Certificat médical
- Au moins 6 vols (pour une durée totale d'au moins 2 h) au cours des 24 mois précédents
  - Si ce n'est pas le cas, vous devez repasser un examen pratique

*That's all Folks!*