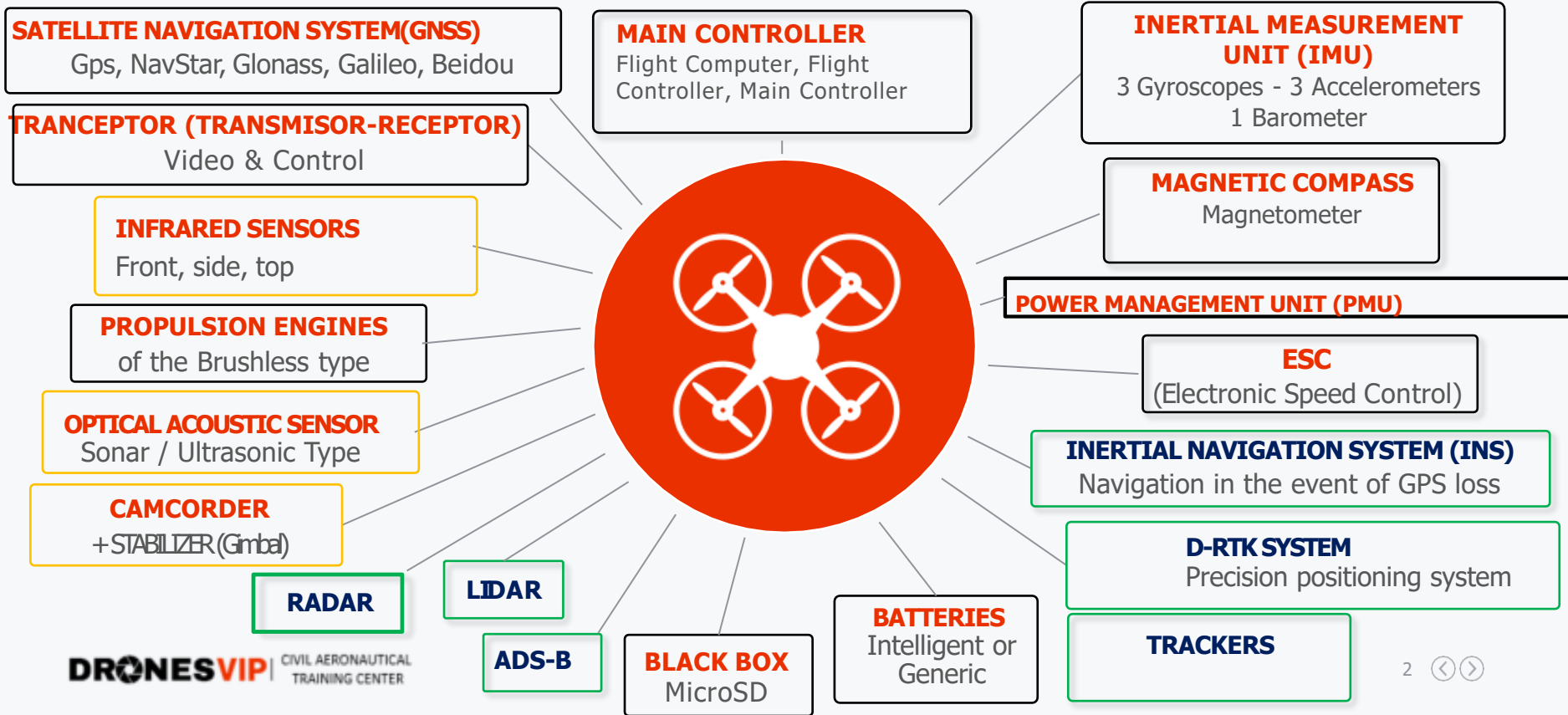


COMPOSITION OF A MULTIROTOR DRONE



MAIN CONTROLLER (COMPUTADORA – FLIGHT CONTROLLER)

This component is the brain of the drone. It receives information from all the sensors and electronic parts that the drone can have, and with that information, and its programming, it executes orders to the ESCs and other parts of the equipment electronics to control everything that happens with the multirotor, where practically all the components are connected.

WHEN CAN IT FAIL?

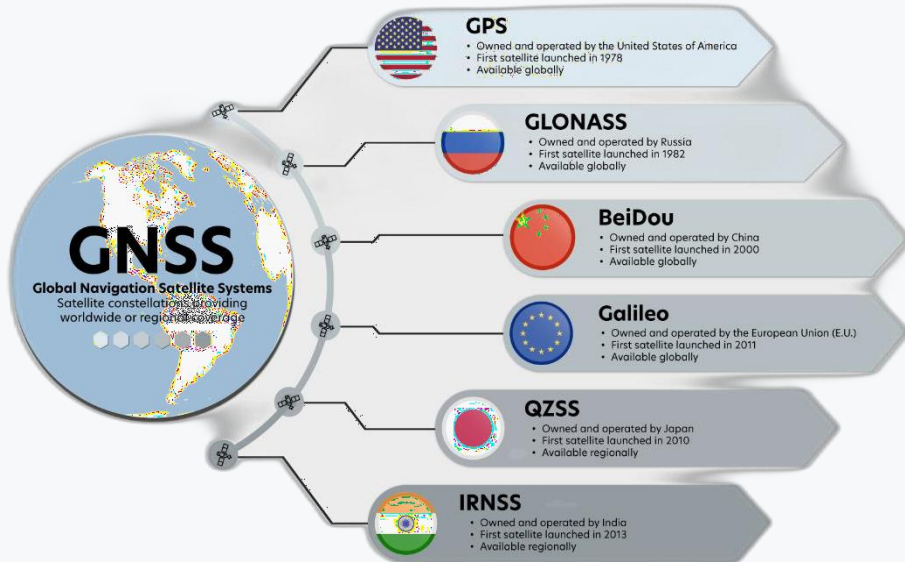
- 01 When the reference values are wrong or the information it receives is not consistent.
- 02 When it gets wet (if it is not watertight), when it is hit, or when it is supplied with incorrect voltage values.



SATELLITE NAVIGATION SYSTEM - GNSS

The GNSS system gives us the possibility of knowing the exact coordinates in the space of the drone (including the height) and being able to navigate with georeferencing. It gives the drone positioning within a local and global frame of reference, and geographical orientation with respect to the Geographic North.

Depending on the model and brand of the drone, it may come with GPS, Glonass, Galileo, Navstar, Beidou, etc.



WHEN CAN IT FAIL?

01

When the operator calibrates the equipment without waiting for the reception of the minimum threshold required by the drone to be reported

(Usually 7 receiving satellites)

02

When it is introduced into a magnetic field or **solar storms with $KP > 4$**

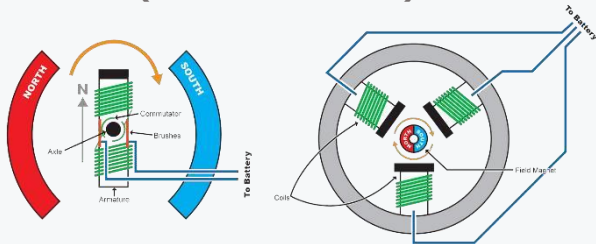
03

When GPS signal is lost due to natural or artificial elements.

ENGINES AND ESC



Brushless Engines
(Brushless – Carbonless)



These are the fundamental components to keep the helirotor in the air:

- ESCs (Electronic Speed Controllers) regulate electrical power to control the rotation of motors with agility and efficiency.
- This rotation is connected to the propellers whose high-speed rotation generates the lift of the helirotor



ESC (Electronic Speed Controllers)



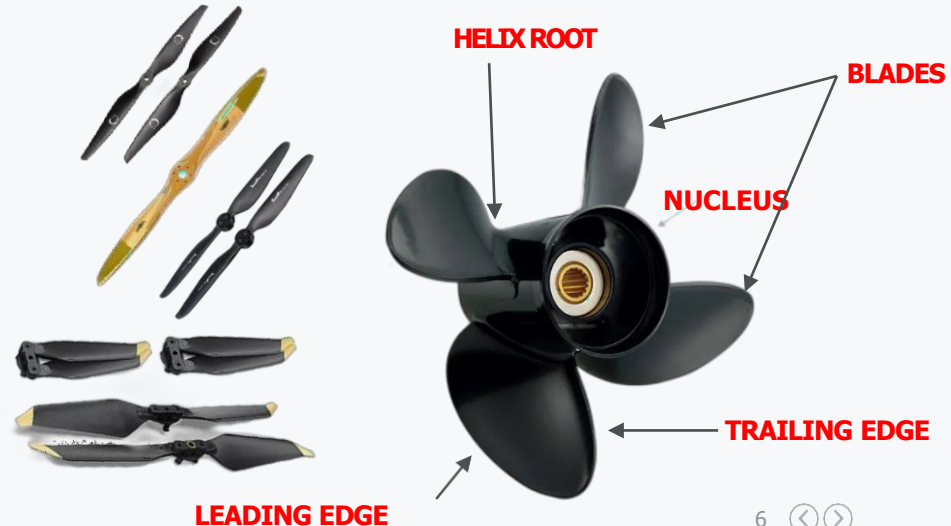
PROPELLERS (FOR THE LIFT OF THE MULTIROTOR DRONE)

The only aerodynamic element of these multirotor units. Its condition, resistance and aging must be observed. As a main check before going out to fly, the pilot or operator must check that it does not have cracks, nicks, dirt, or is poorly placed in the engine or loose. It is the main part where lift occurs, and allows these teams to move through the air or stay still suspended in one position. **There are several ways to fasten the motors, they can be screwed, locked, or fastened by screws or nuts.**

They come in different materials, from wood, plastic, aluminum or carbon fiber. **They can be clockwise (CW) or counterclockwise (CCW),**

WHEN CAN IT FAIL?

- 01** When they have more hours of use than the maximum indicated by the manufacturer
- 02** When they are not original or made of good material
- 03** When the operating pilot does not check them prior to the flight.



INERTIAL MEASUREMENT UNIT (IMU)

It is an electronics that brings together a set of sensors. In these unmanned vehicles, they are basically composed of 3 (Three) Electronic Gyroscopes, 3 (Three) Electronic Accelerometers and 1 (one) Barometer. It must be calibrated the first time we take the drone out of the box, and then if the software or application does not give us an error, or if it does not have very significant deviations, it is not necessary to calibrate it.

WHEN CAN IT FAIL?

- 01 When the equipment is detached from the calibration temperature of the IMU
- 02 When the values manifested are out of range or with very large deviations.



Example of the DJI Phantom 4 IMU

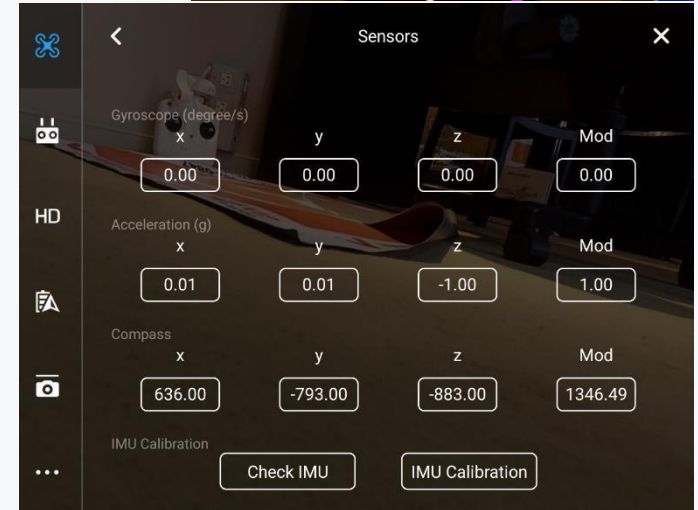
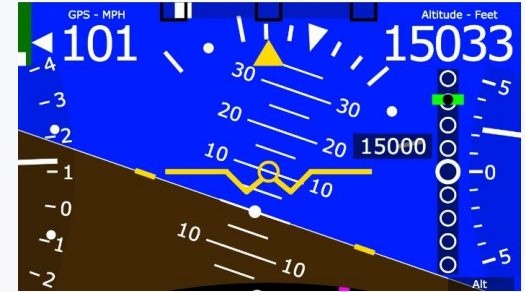
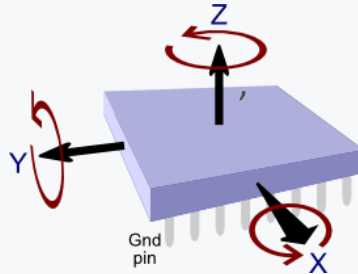


GYROSCOPES AND ACCELEROMETERS (ELECTRONIC)

This sensor measures the drone's location angles in the air. Typically, the electronic gyroscope is built into the same unit as the accelerometer inside the IMU. The accelerometer measures acceleration and the gyroscope measures the angle at which the drone is located and/or the rate of rotation on each of the main axes. They are very small and are called MEMS (Microelectromechanical Systems).

WHEN CAN IT FAIL?

- 01 When initialized at an angle greater than 10° .
- 02 When it is hit and loses standard calibration.

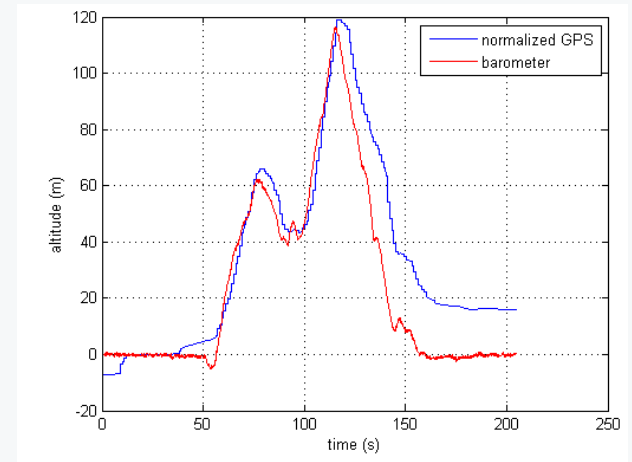


BAROMETER

The barometer uses the atmospheric pressure parameter to have an altitude reference. Atmospheric pressure is the force exerted by atmospheric air on the earth's surface. The higher the height of the earth's surface with respect to sea level, the lower the air pressure. These parameter changes are taken by the barometer to have a reference of the altitude of the drone with respect to its take-off site. Remember that the barometer is part of the **IMU (inertial measurement unit)**

WHEN CAN IT FAIL?

- 01 When the team received a blow and the recalibration of the IMU was not performed.
- 02 When the sensor is clogged or dirty.

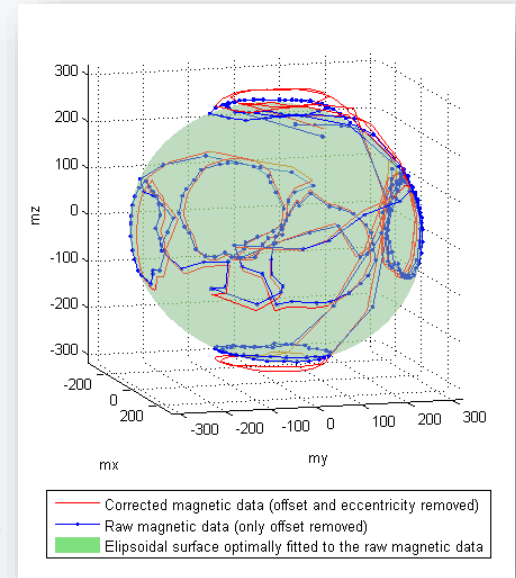
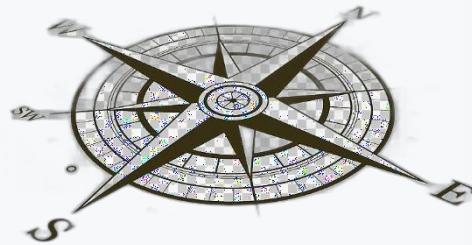


MAGNETIC COMPASS

The drone needs a sensor that gives different readings when it rotates horizontally. This feature is achieved through the use of magnetometer, or magnetic compass. The magnetometer is simply a compass that serves for readings in X--Z directions. The compass is generally not integrated into the main controller or within the IMU. This sensor is prepared to measure the Earth's magnetic flux and give the computer the information of **MAGNETIC COURSE**.

WHEN CAN IT FAIL?

- 01 When less than 2 m from ground level the surface on which it was calibrated changes, or there are metal elements nearby.
- 02 When induced within an electromagnetic field



QUESTION TIME!