Intro to Small Unmanned Aircraft Systems & Recreational Drones

Flight Modes

Flight Modes have to do with how the flight controller (the computer chip that controls the motors of the drone) assists the pilot with flying the drone. Many flight modes provide autonomous control of the drone without pilot input. Flight Modes may be changed in flight to adjust to changing conditions. Some Flight Modes may not be available until the drone is in the air.

Flight Modes

Flight Mode names vary by manufacturer. In general, they fall into two categories:

Basic or Standard Flight Modes – varying levels of pilot control

Intelligent Flight Modes – partial to fully autonomous control of the drone

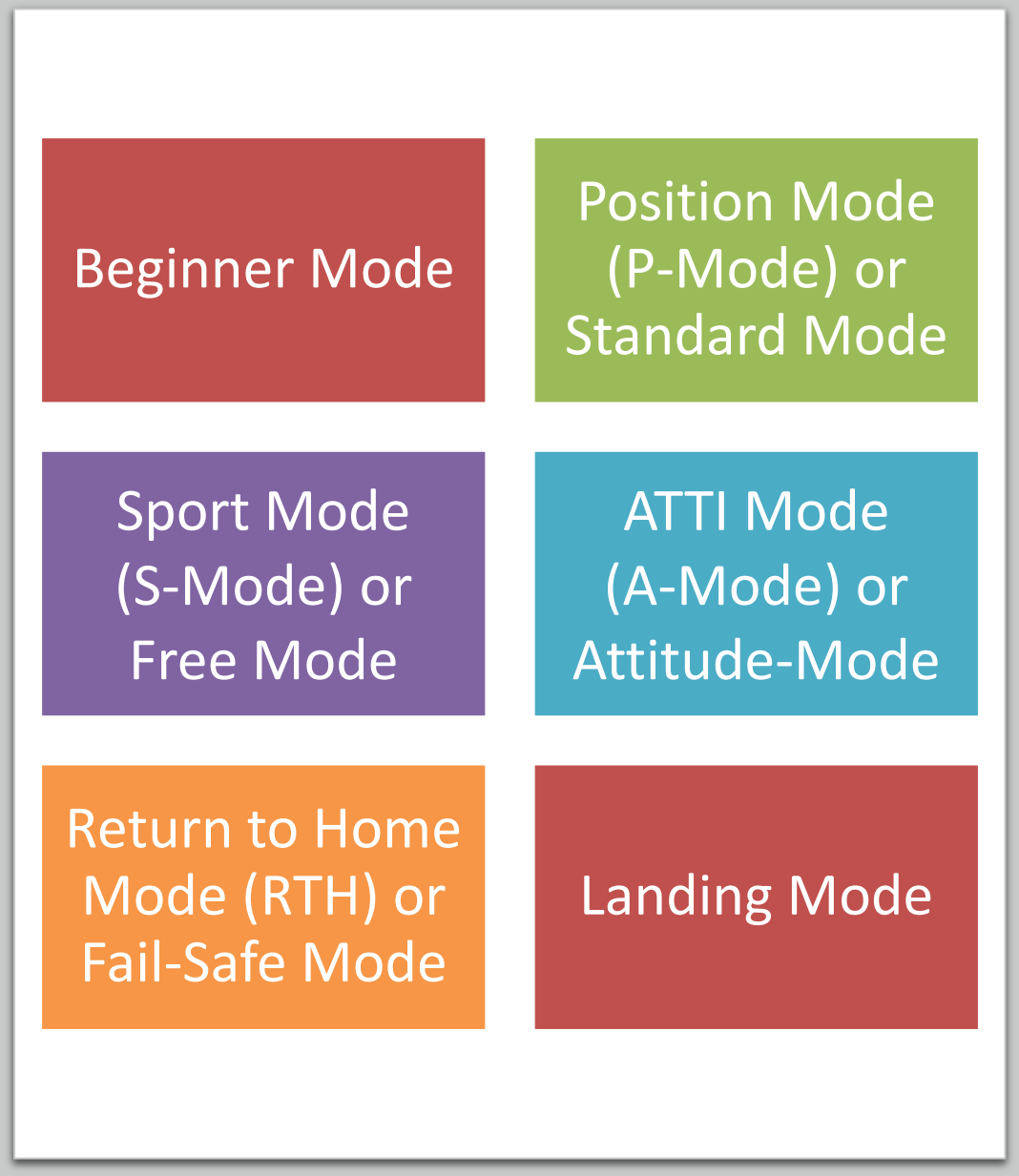
Flight Safety

FAA Rules for sUAS and model aircraft require the pilot to avoid any manned aircraft and any other unsafe operation. Therefore, a drone pilot must instantly be able to abort any programmed or automated flight mode, take control of the aircraft and avoid any dangerous situations.

Obstacle Avoidance

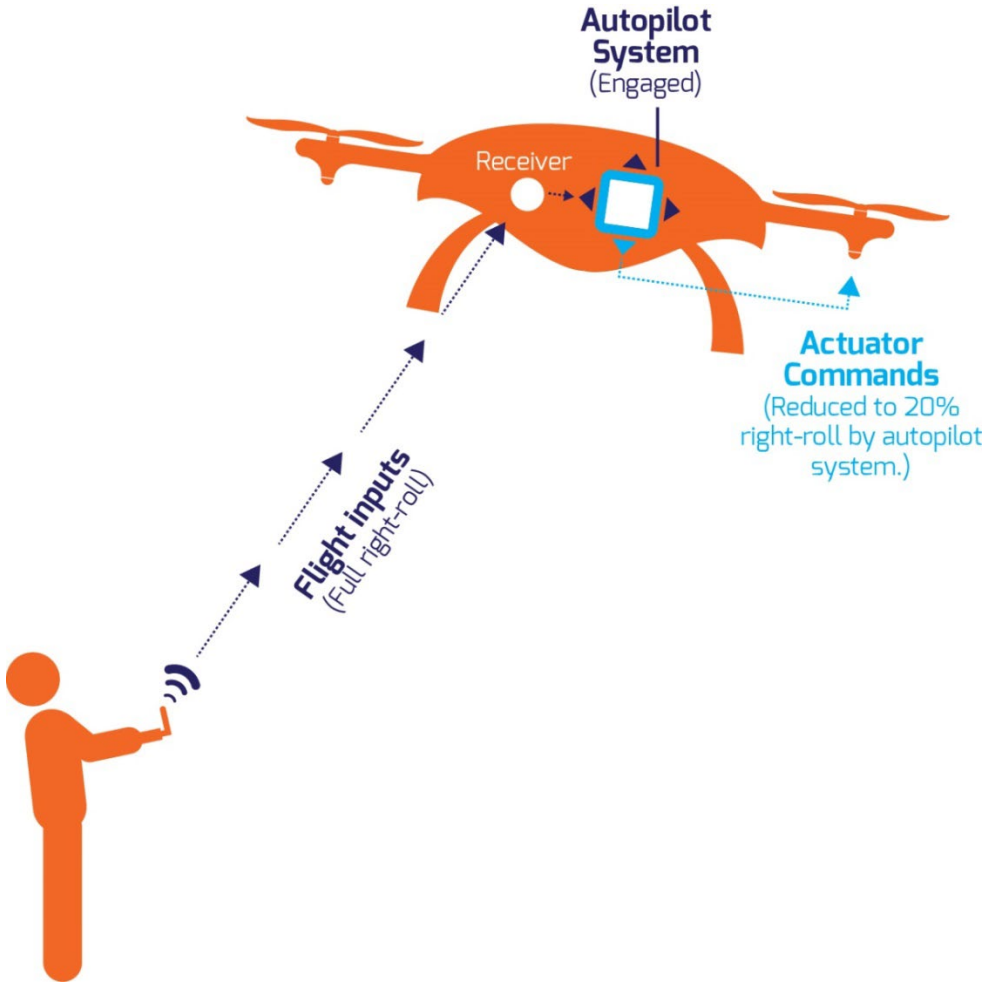
The drone will not fly into a solid object such as a building or wall. May not work for small tree branches, guywires or power lines.

Basic / Standard Flight Modes



Beginners Mode

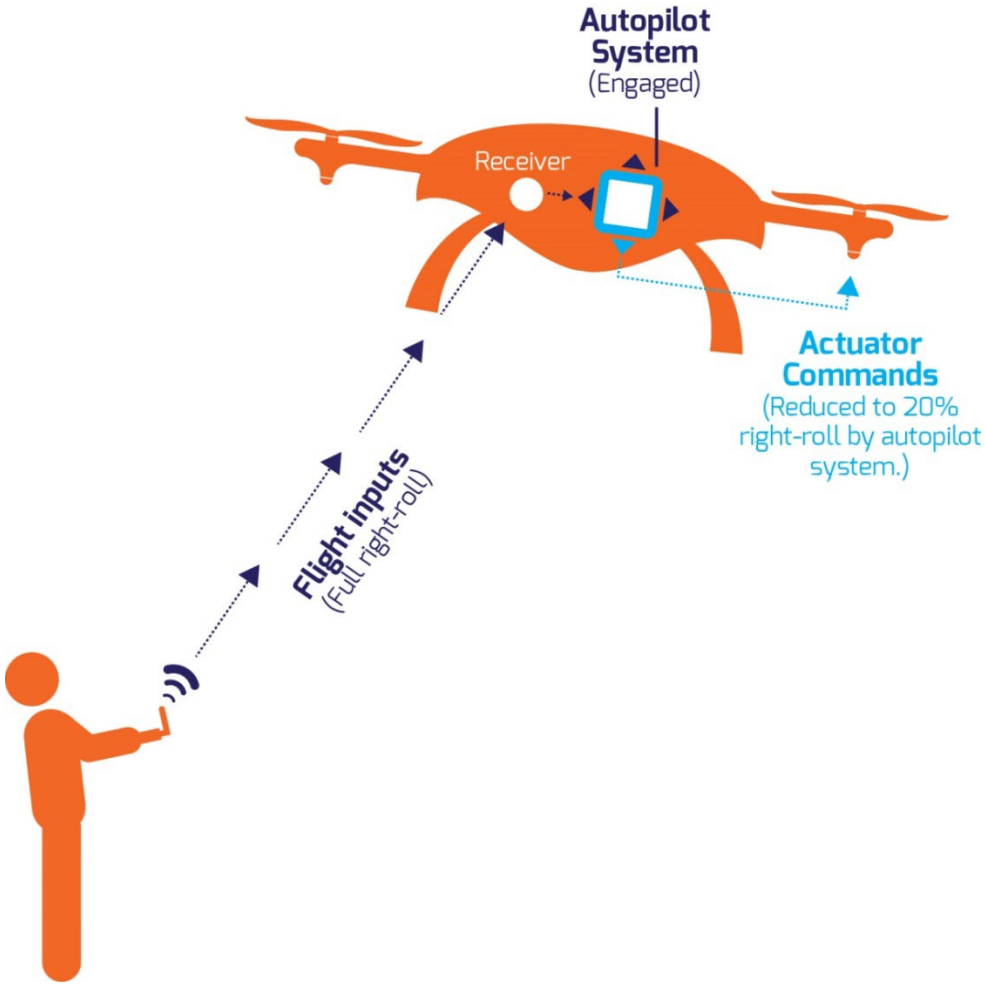
Beginners Mode will automatically return the drone to a level hover whenever the sticks are in the neutral position. It may also limit the distance and height the drone can fly.



Position Mode (P-Mode), Standard Mode or Stabilization Mode

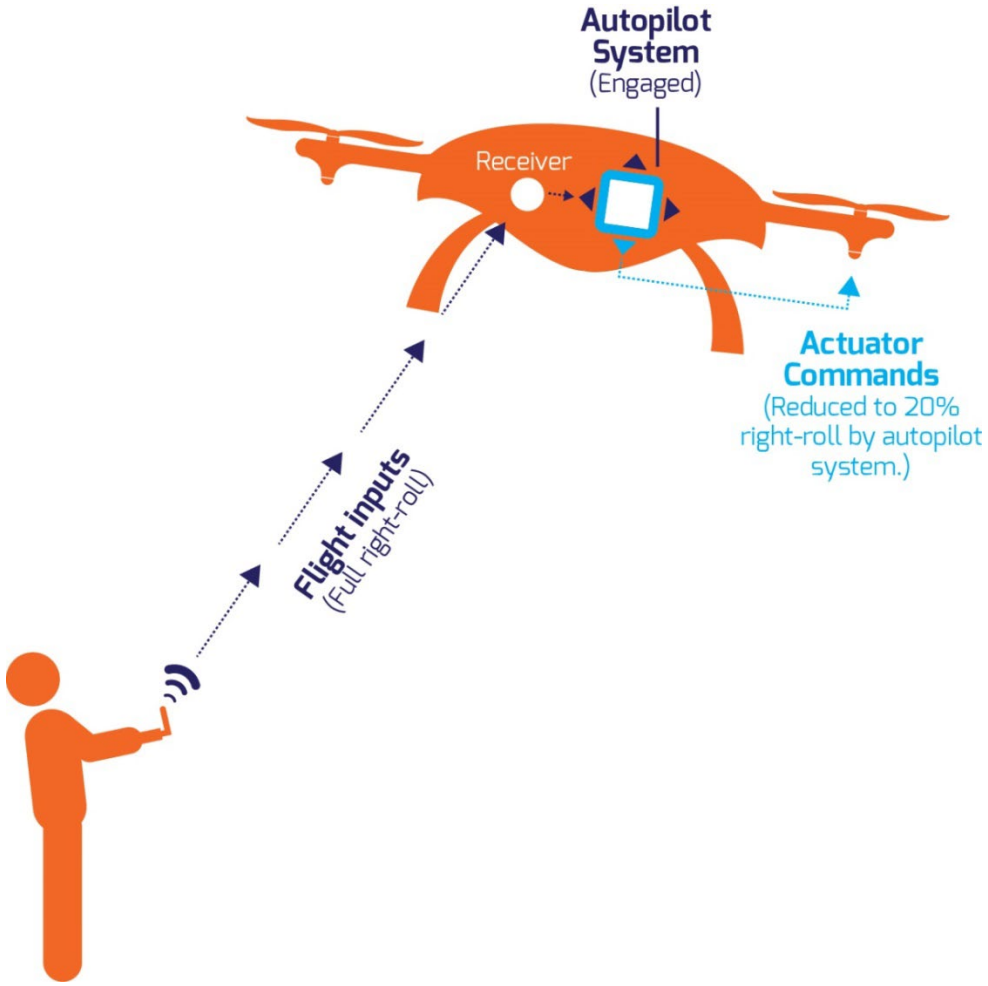
The drone is under the direct control of the operator, but stabilization system is engaged to keep the drone flying level. This is made possible with an onboard piezo gyroscope and accelerometers.

This mode limits the maximum speed, pitch and bank angles.



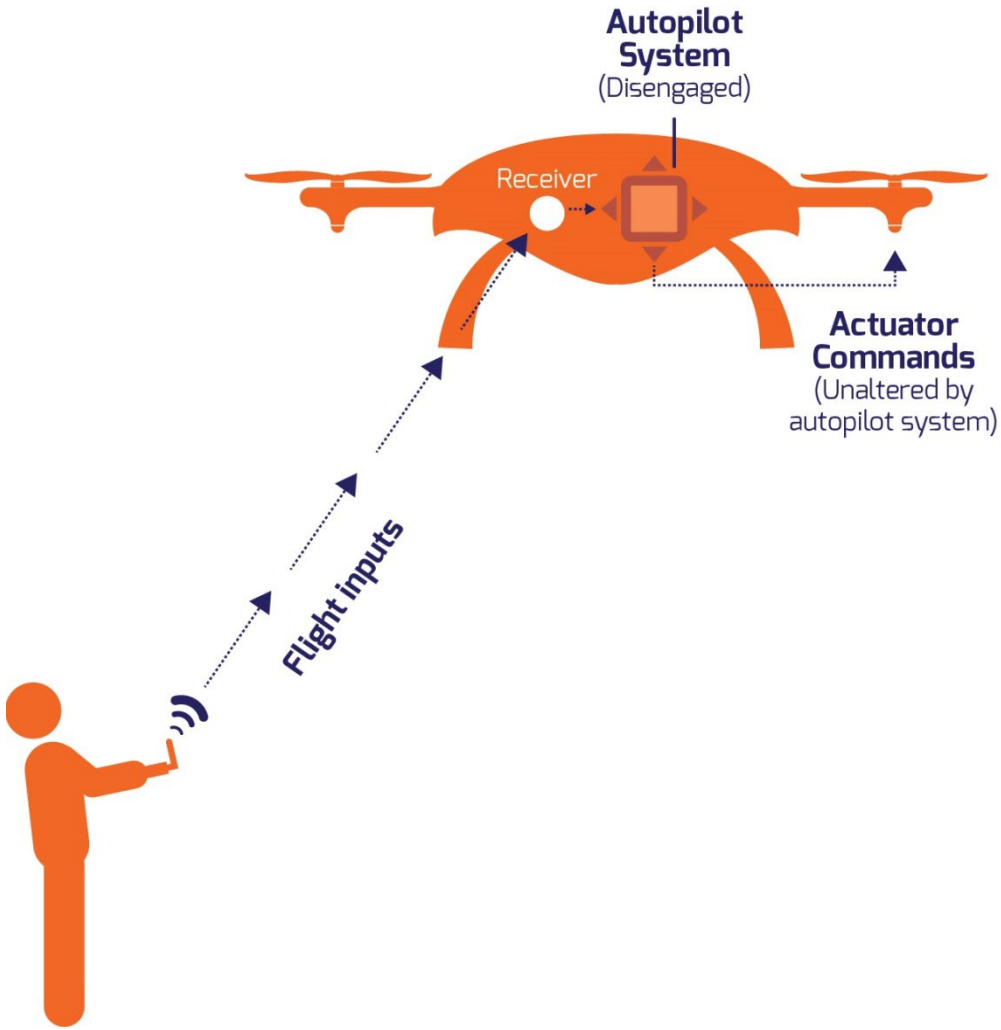
Intermediate Modes

Various **Intermediate Modes** allow a more advanced flight envelope but prevent extreme flight attitudes.



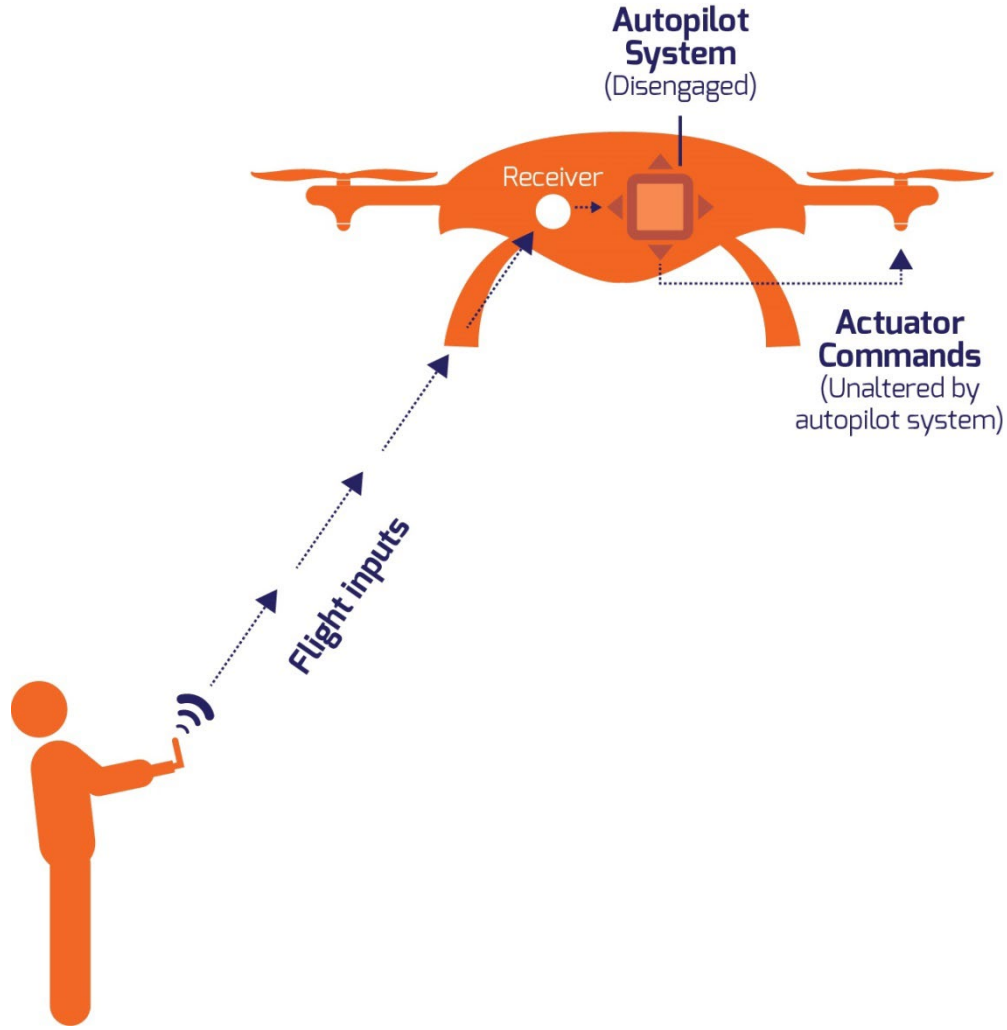
Expert or Sport Mode

Expert or Sport Mode provides minimal stabilization, and the pilot has full control of the drone. Expert Mode is only used when the pilot wants to perform extreme maneuvers with the drone. Also called **Agility Mode**.



ATTI Mode (A-Mode) or Attitude-Mode

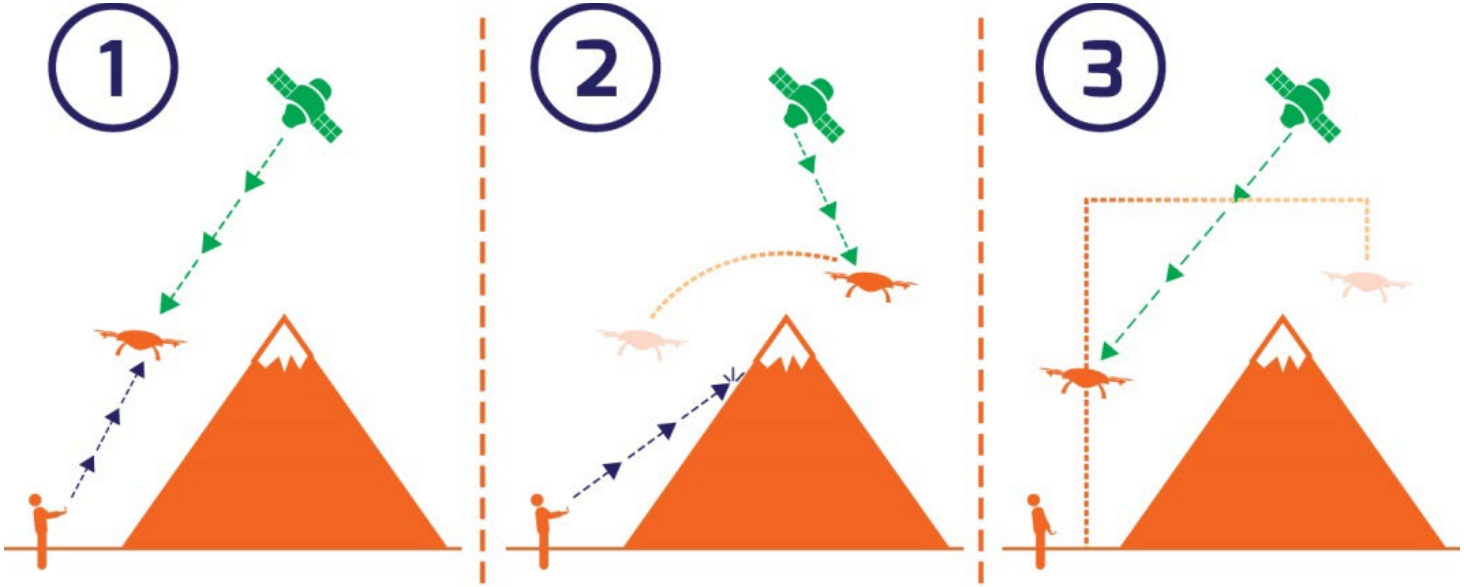
In **ATTI Mode** the drone maintains constant altitude using barometric pressure. The position won´t be stabilized using GPS, so it will drift with the wind.



Return to Home

May be initiated on the transmitter, by loss of transmitter signal or by low battery.
Always establish the “home” location before departing.
Return flight path is at a preset minimum altitude.

Failsafe Mode / Return to Home



Position #1

- Aircraft reveiving pilot input.
- Aircraft receiving GPS signal.
- Autopilot disengaged.

Position #2

- Pilot input interrupted.
- Aircraft receiving GPS signal.
- Autopilot automatically engaged.

Position #3

- Aircraft receiving GPS signal.
- Autopilot commands aircraft to gain altitude, then return back to 'home' position.

Return to Home Failures!

Return to Home not set at takeoff

- Some drones have attempted to return to a previous flight location because Return to Home was not initialized.

Battery runs out before drone can Return to Home

- Drone can get too far downwind to return.

Drone runs into obstacle while Returning to Home

Loss of GPS signal will prevent drone from Returning to Home

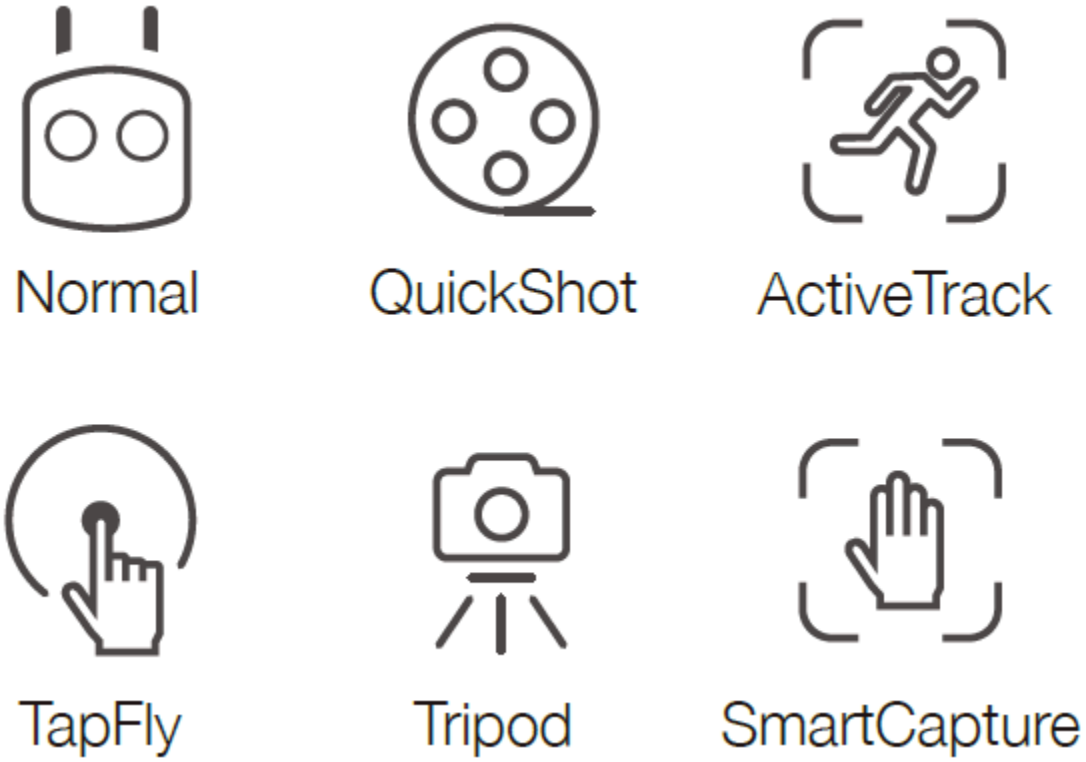
Landing

Makes an immediate controlled descent, slowing as the ground approaches. May shut-off motors after landing.

Does not return to Home Point!

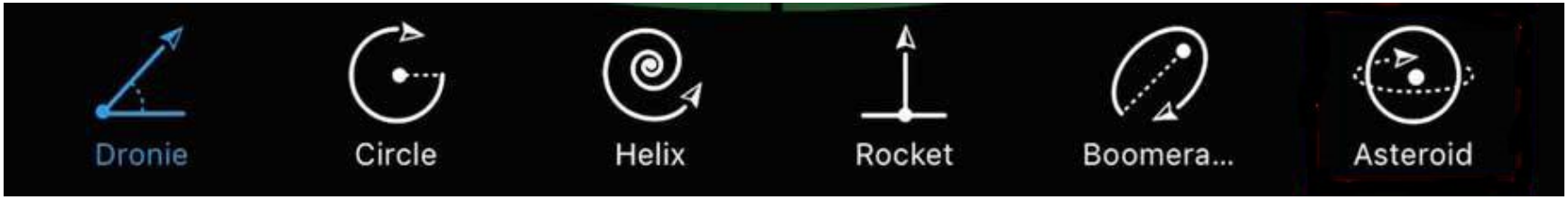
Intelligent / Advanced Flight Modes

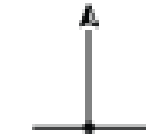
DJI QuickShot



DJI groups several Flight Modes in the QuickShot category

DJI QuickShot





Rocket Mode

Ascend with the camera pointing downward, revealing a unique perspective from above.

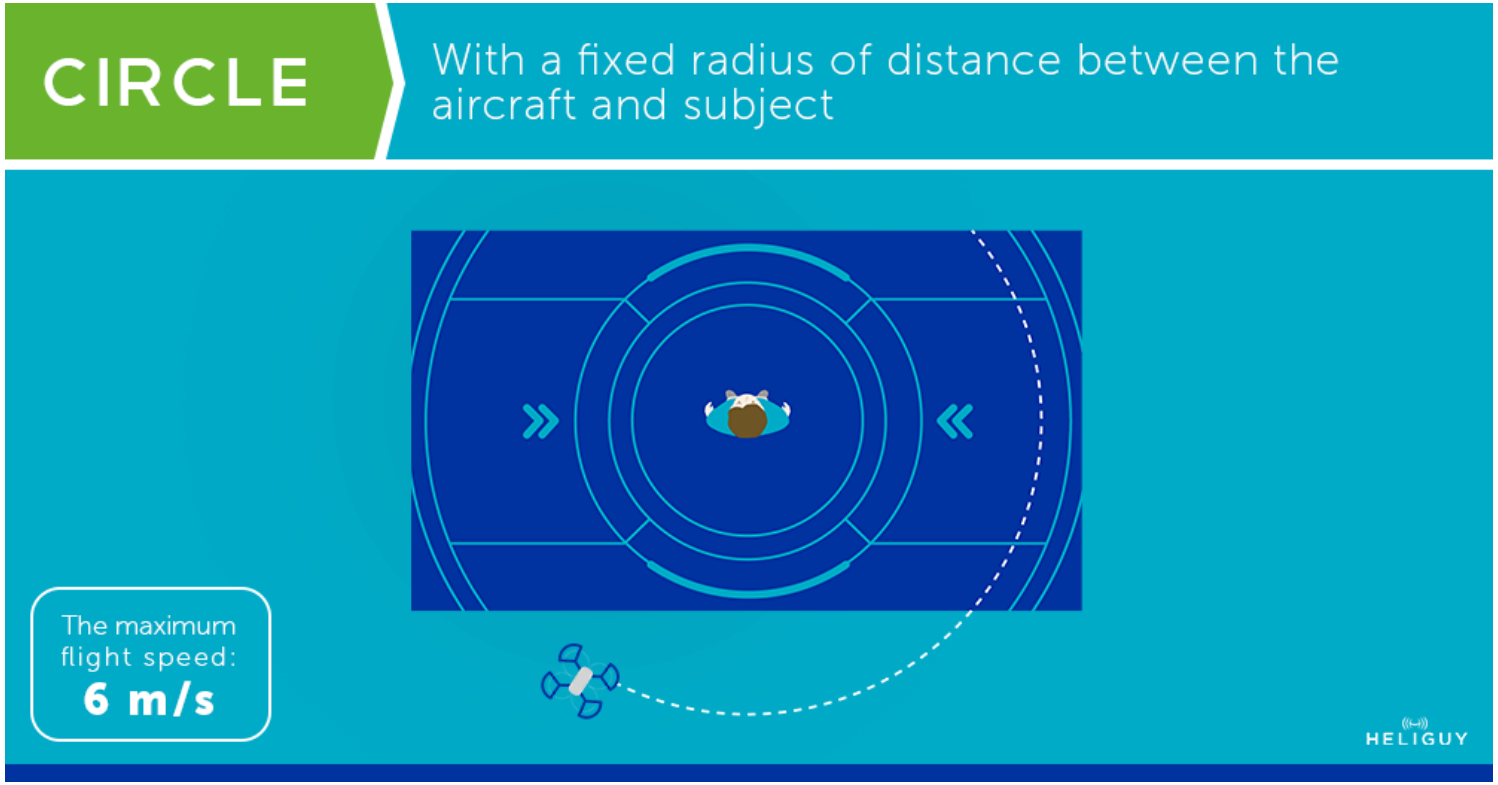
DRONIE

Dronie Mode

Fly backward and upward, with the camera locked on your subject, creating an epic shot.

Circle Mode

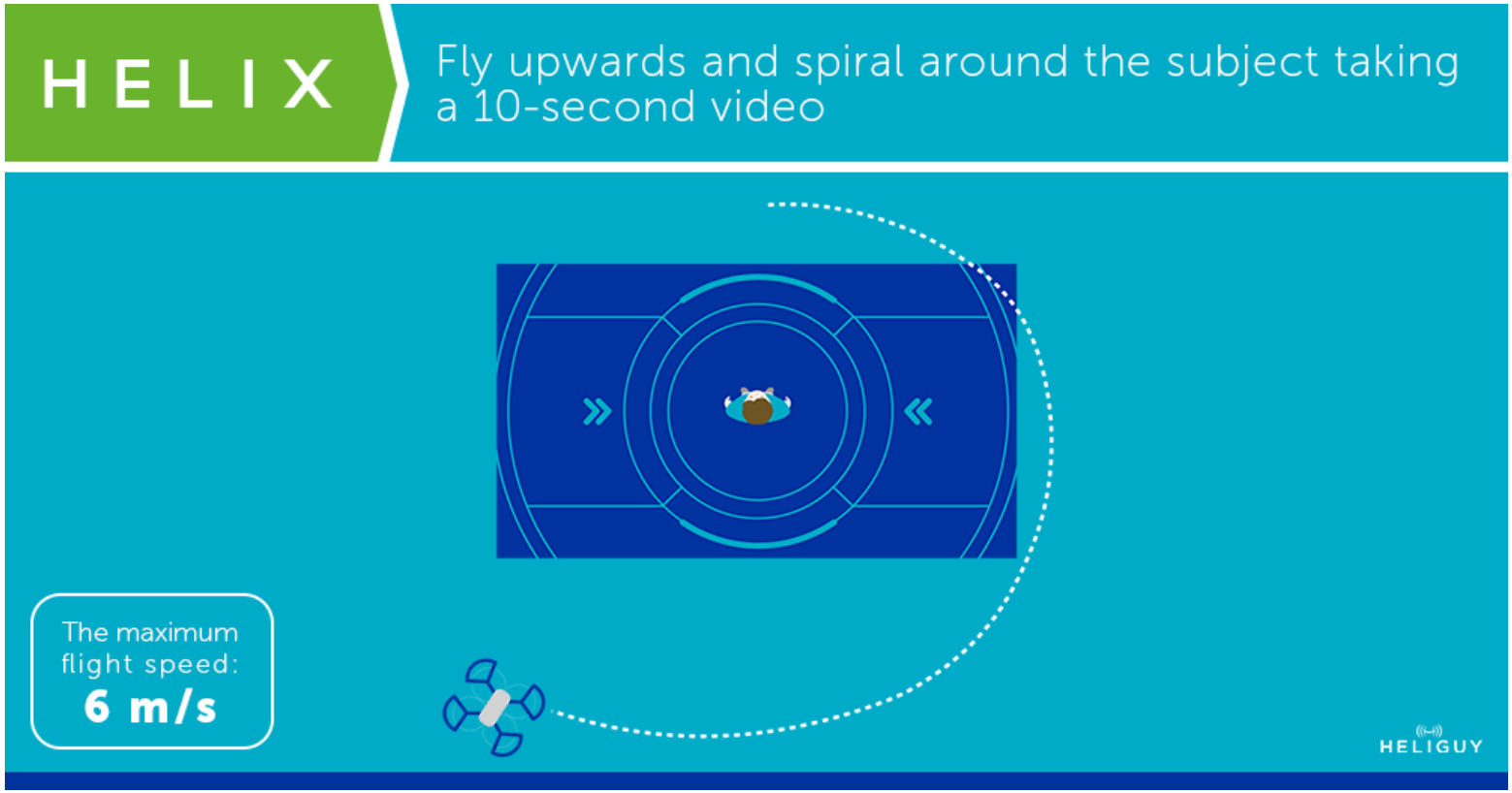
Keeps the subject locked in the center of the frame.



Helix Mode

HELIX

Starts close to the subject before flying up, away, and around in larger and larger circles.



Boomerang

Asteroid

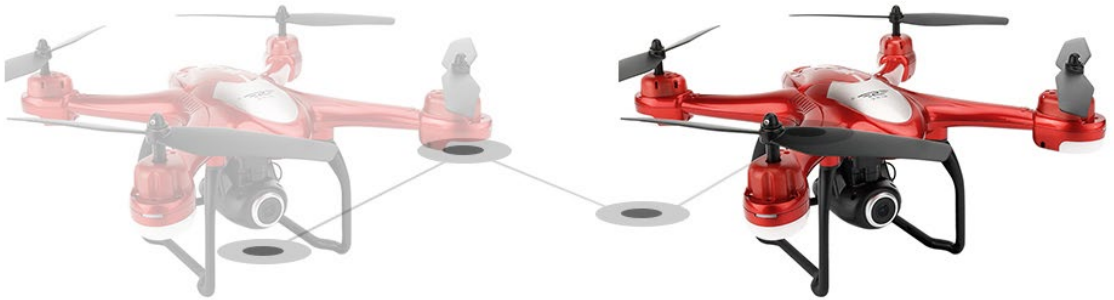
Active Track or Follow Me

Active Track uses the drone camera to follow an object. It cannot track under trees or in a tunnel. **Follow Me** tracks the transmitter by GPS. (Some use a beacon.) Both may have a maximum tracking speed.

Active Track or Follow Me

Spotlight – keeps the camera pointed at the subject during flight.
POI (Point of Interest) – allows movement around the subject
Parallel – tracks the subject at a constant angle and distance from the front and side.
Profile – fly alongside the subject.
Trace – tracks the subject at a constant distance. It follows the subject and keeps it in the frame.
Hyperlapse – records video and allows you to adjust the speed – so now you have a single streaming image moving as quickly, or slowly, as you'd like.

Tap Fly

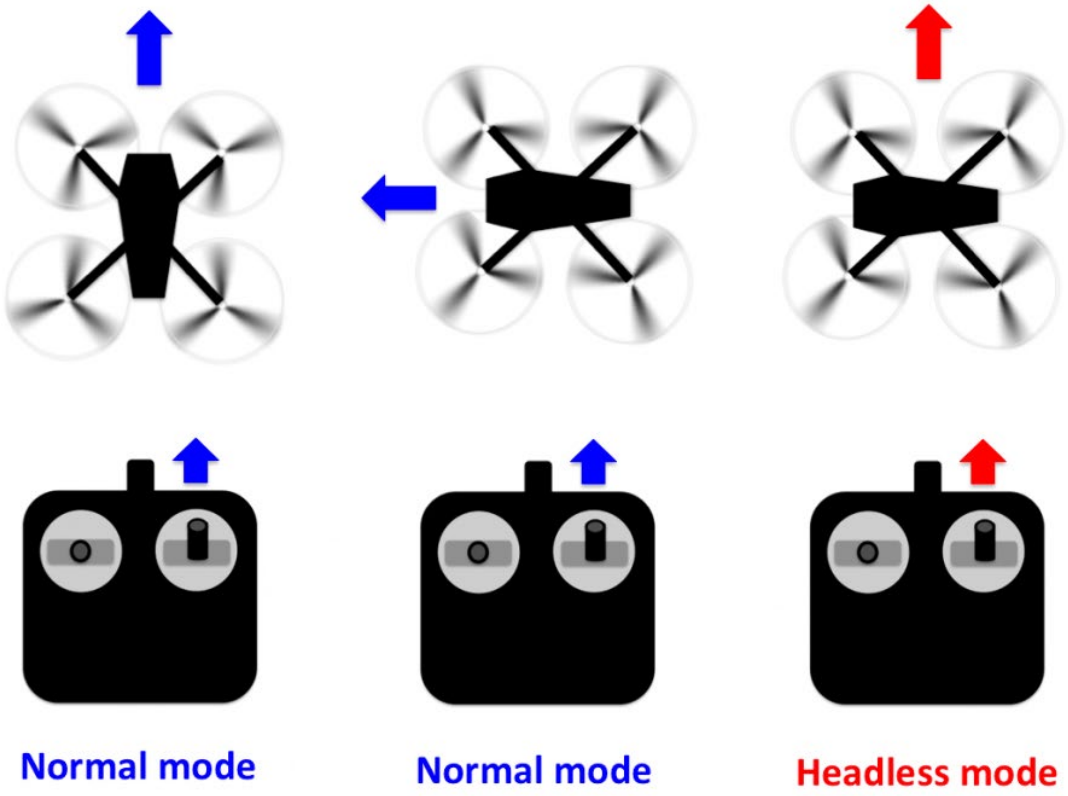


Tap location on screen and drone flies there

Tripod & Cinematic

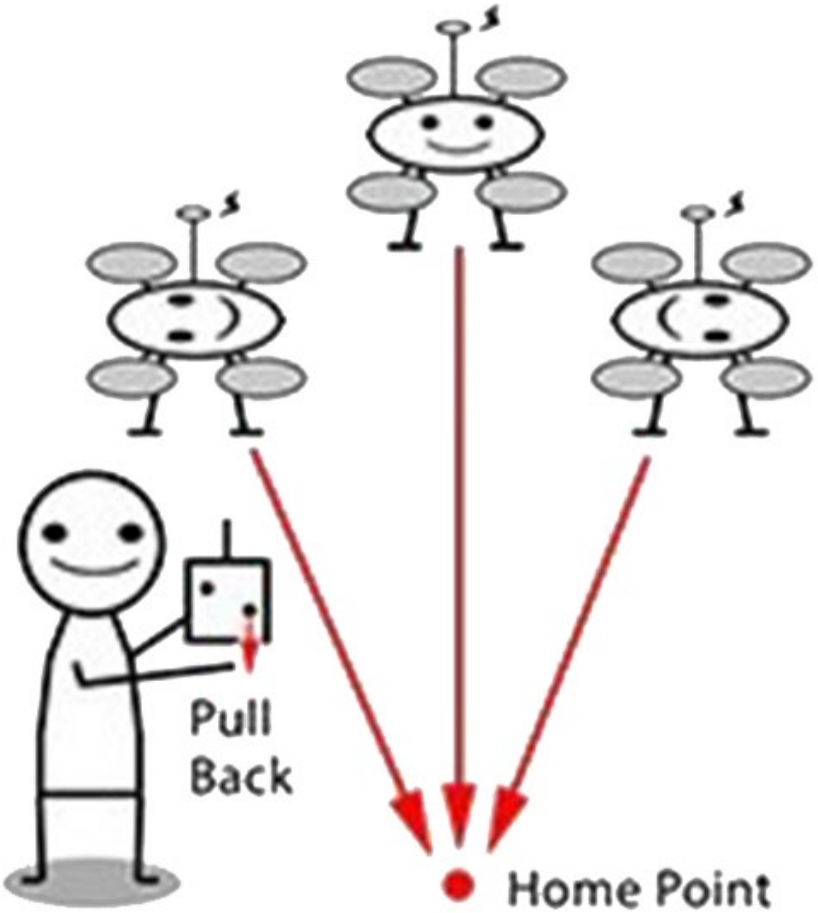
Tripod & Cinematic modes have very slow movements that are useful when taking photos or movies without blurring. Cinematic mode slowly decreases yaw as the aircraft turns to its final heading.

Course Lock or Headless Mode



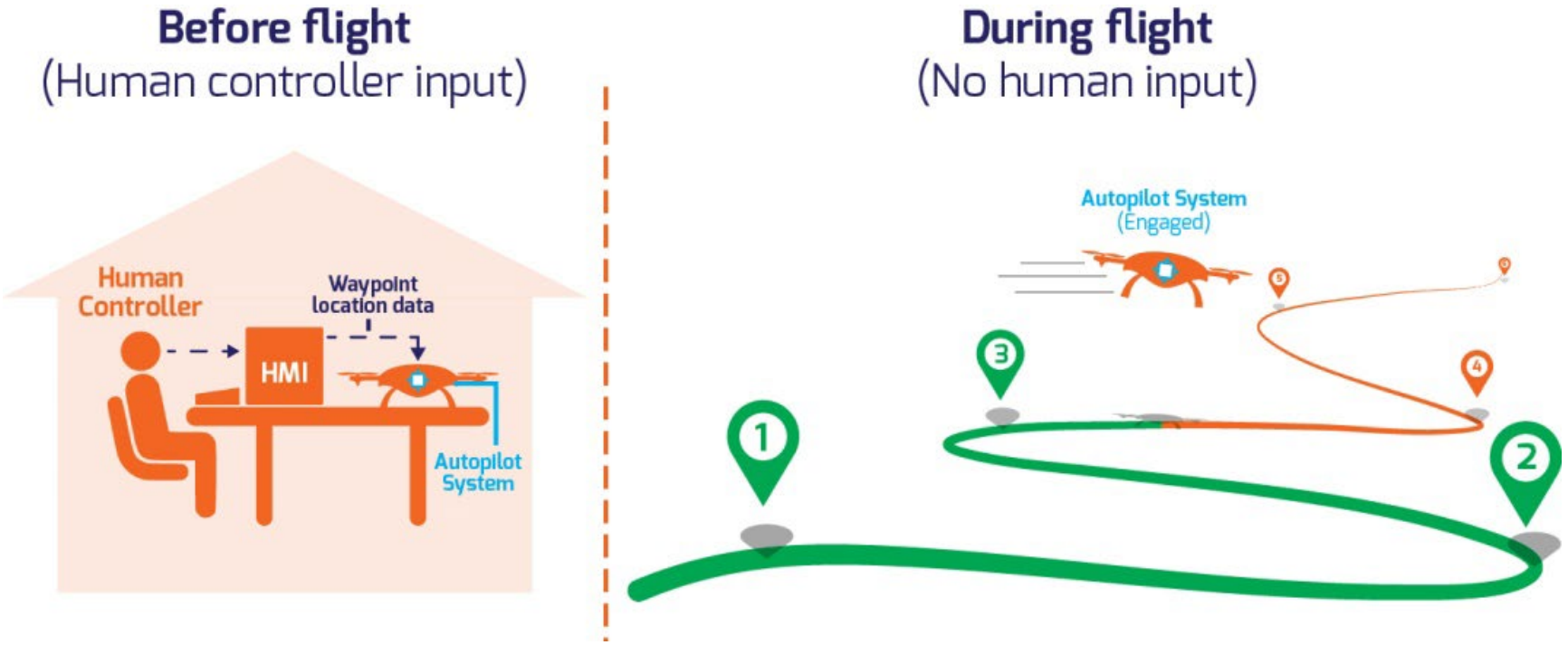
Set Course Lock or Headless Mode before take-off.

Home Lock



No matter what the orientation, pulling back will bring the drone toward the Home Point at its current altitude

Waypoint Mode



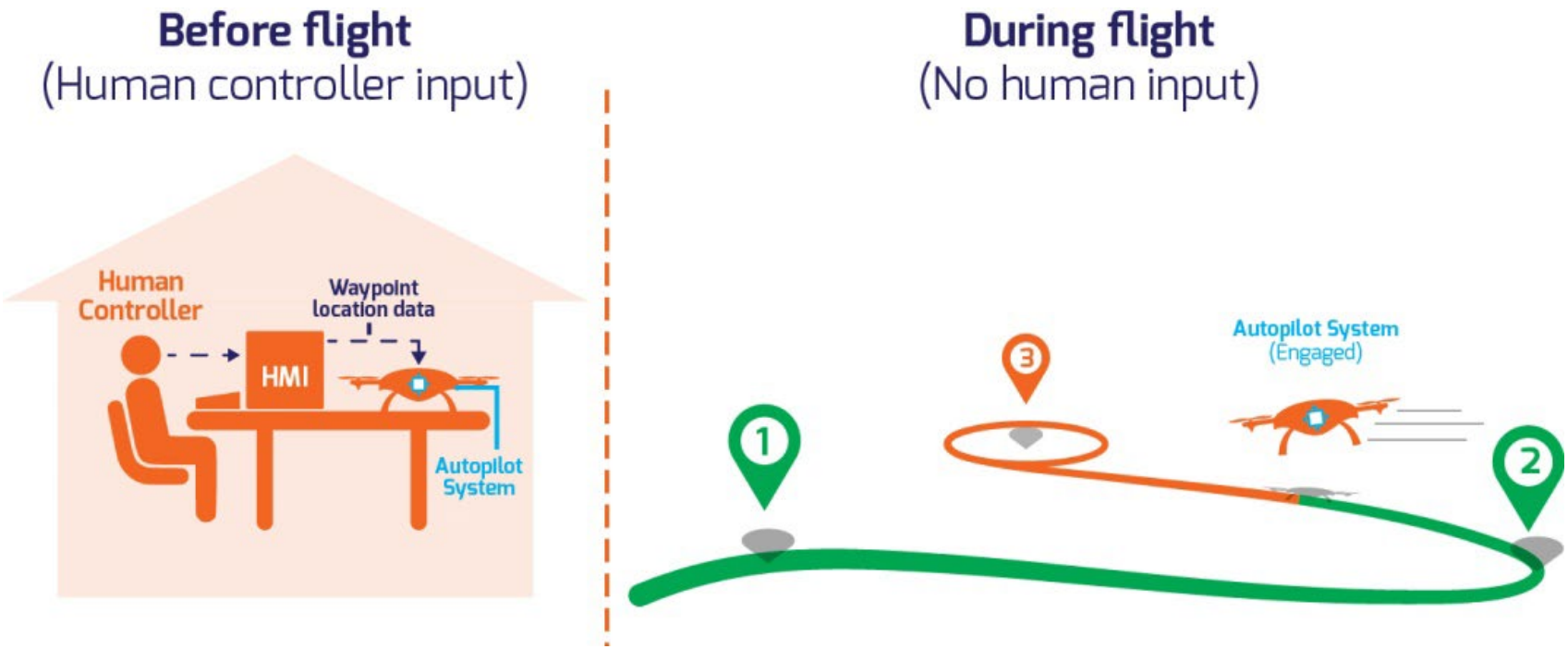
Waypoints are reference points in three-dimensional (3-D), physical space used for navigation. Normally an operator develops a mission, or *flight plan,* as a series of waypoints. The waypoints are arranged in a deliberate manner such as an airspace corridor, or around a target of interest.

Operators can assign specific commands, altitudes, and airspeeds for these waypoints, both collectively and individually.

Fixed Wing Mode

In **Fixed Wing Mode**, yaw motion is limited. Gives realistic “cockpit view” FPV video.

Loiter Mode



This flight mode is used to put the drone into an orbit around a fixed point at a predetermined radial distance. This is typically used in fixed-wing drones to orbit over an area.

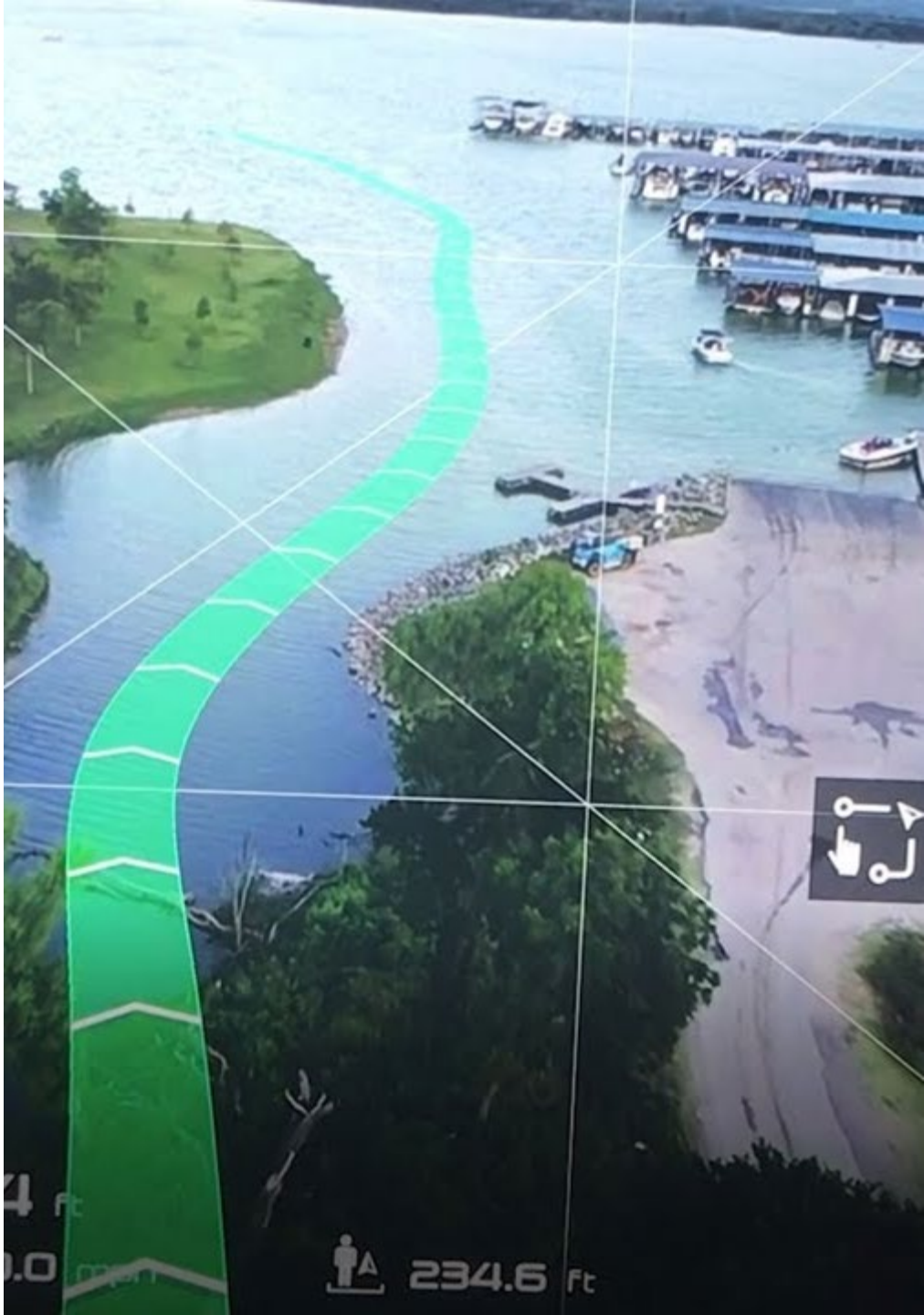
Terrain Follow

Drone will maintain a constant altitude above ground level (AGL).

Usually in combination with another mode such as Follow Me

Draw Mode

In **Draw Mode**, you draw a flight path on the screen and set the speed. Camera movement is independent of the drone flight path allowing side view videos.

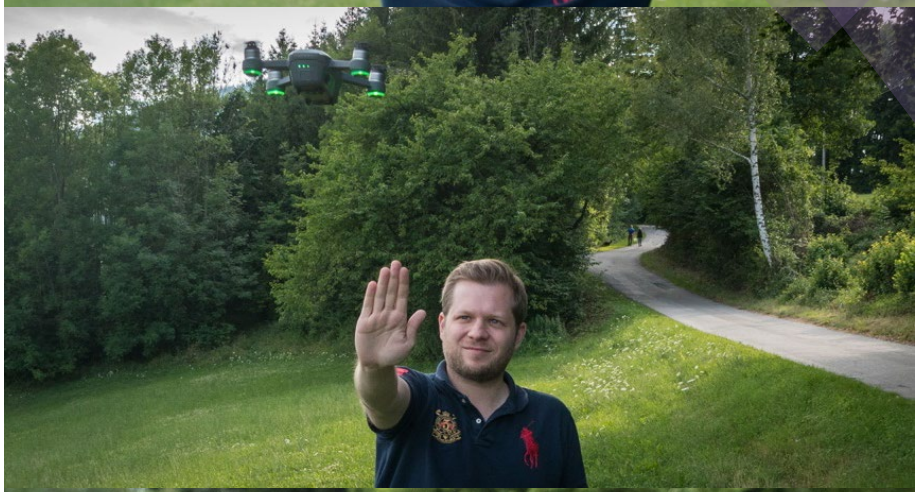


Special Modes

- Gesture Mode
- S.A.F.E. Mode
- Geofencing

Gesture Mode

Control the drone with hand gestures – good for up to 100 feet from subject to drone.



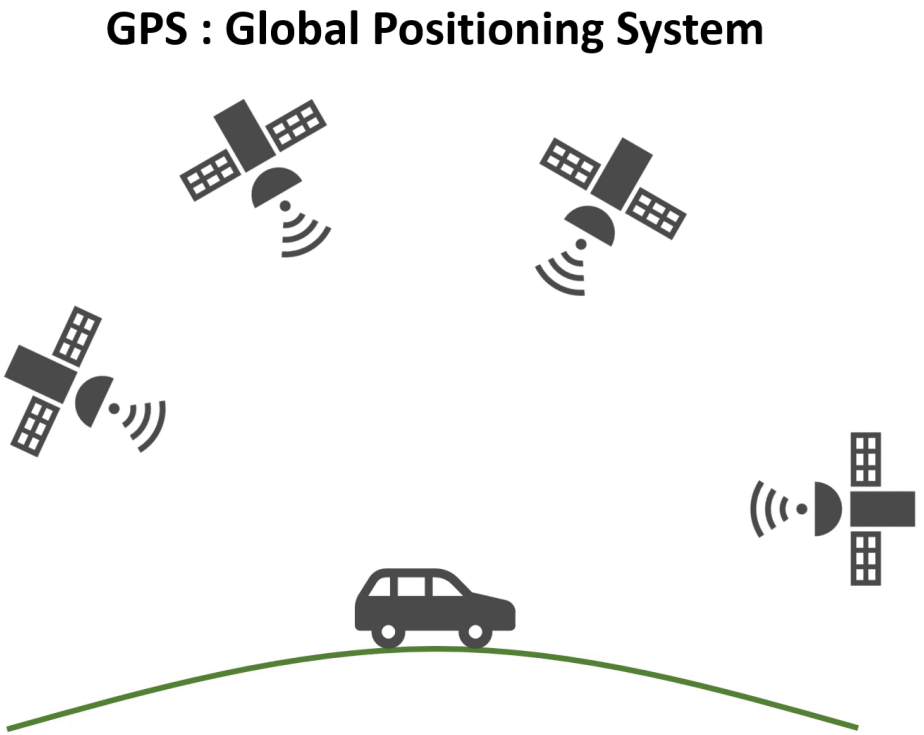
S.A.F.E. Mode

With SAFE™ (Sensor Assisted Flight Envelope) technology from Horizon Hobby, you can fly in multiple modes and instantly return to steady flight using the Panic Recovery trigger in any flight mode.

Other manufacturers offer similar features.

Advanced Features

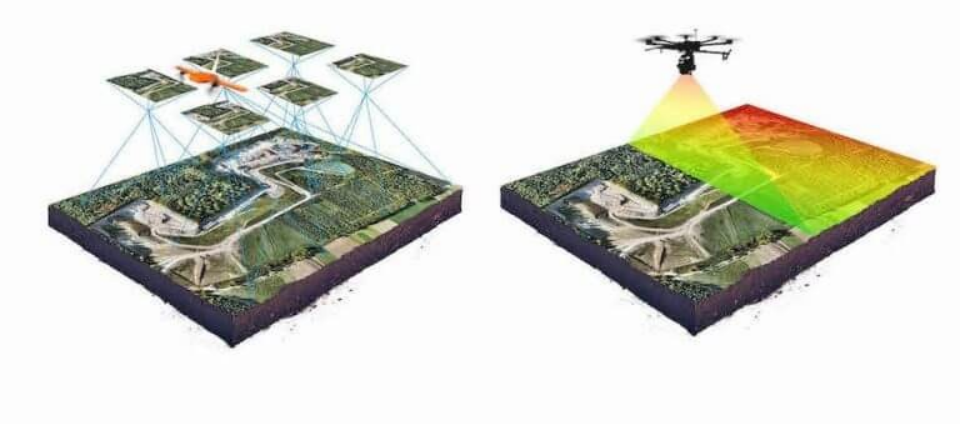
Geofencing – the use of GPS technology to create a virtual geographic boundary, enabling the onboard computer to take control of the drone when approaching the boundary. Geofencing can be used to keep a drone from flying outside a defined area or it can be used to prohibit a drone from flying in a restricted area.



Aerial Surveying

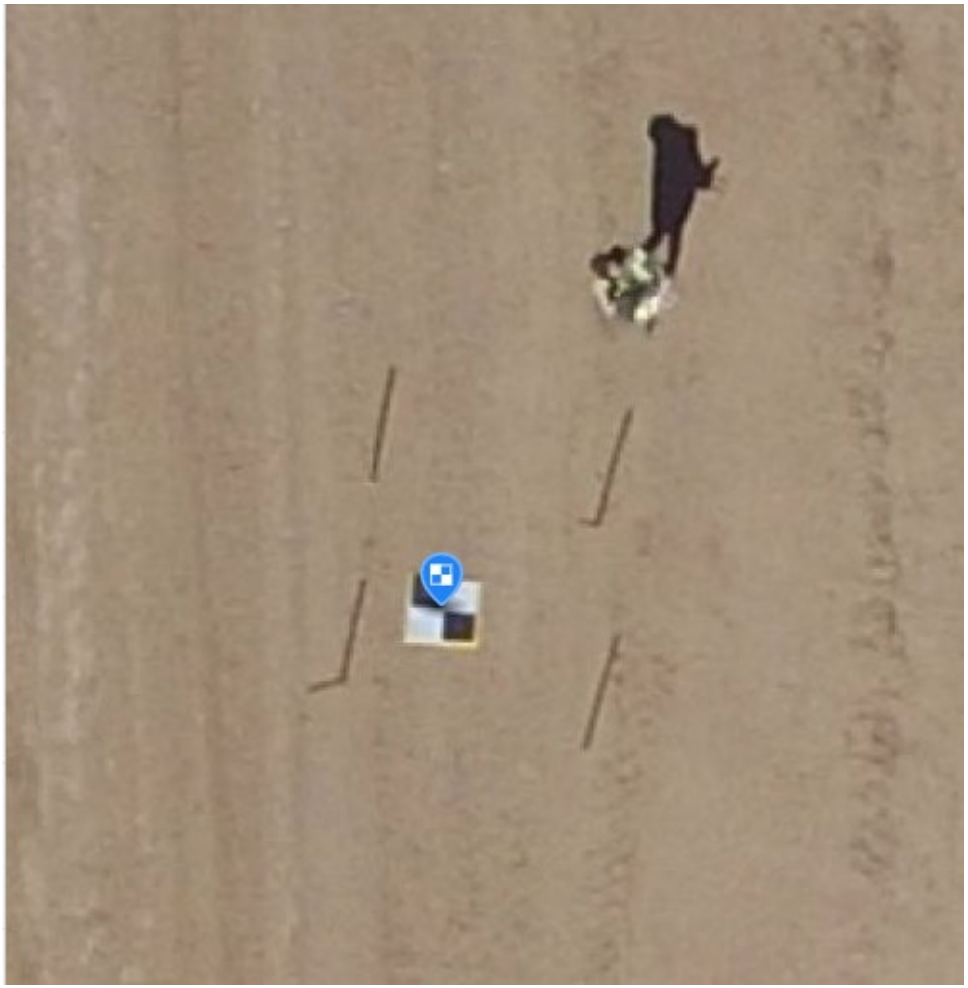
Aerial surveying is the process of collecting data about an area of land or terrain from the air, using aircraft or drones equipped with specialized sensors and cameras. Three methods of aerial surveying are:

GCP – Ground Control Point
RTK – Real-Time Kinematic
PPK – Post Processed Kinematic



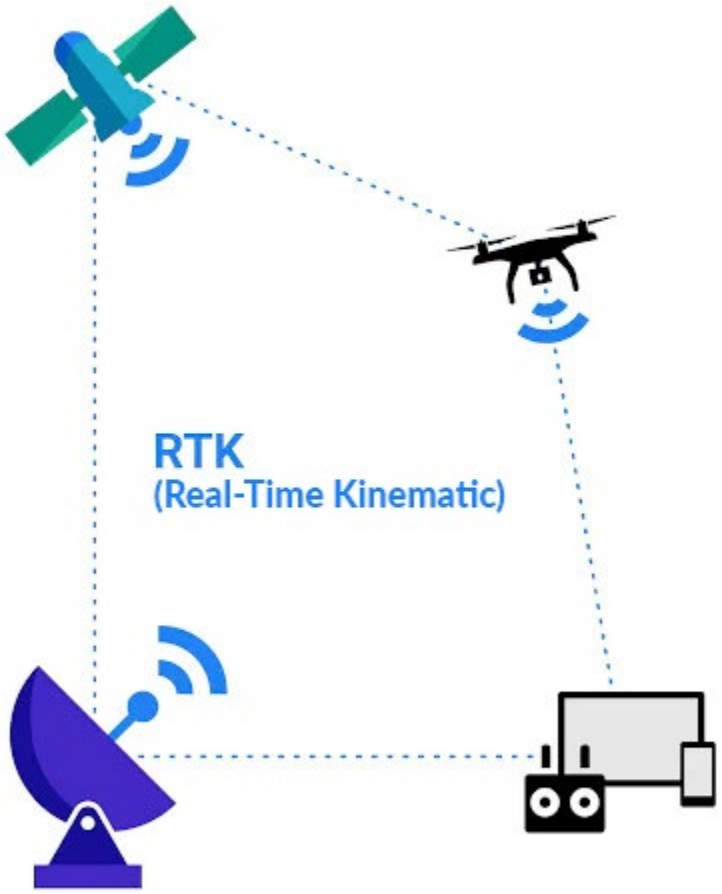
GCP – Ground Control Point

Uses GPS to gather data relative to a fixed point on the earth's surface and uses those points to geo-reference aerial imagery



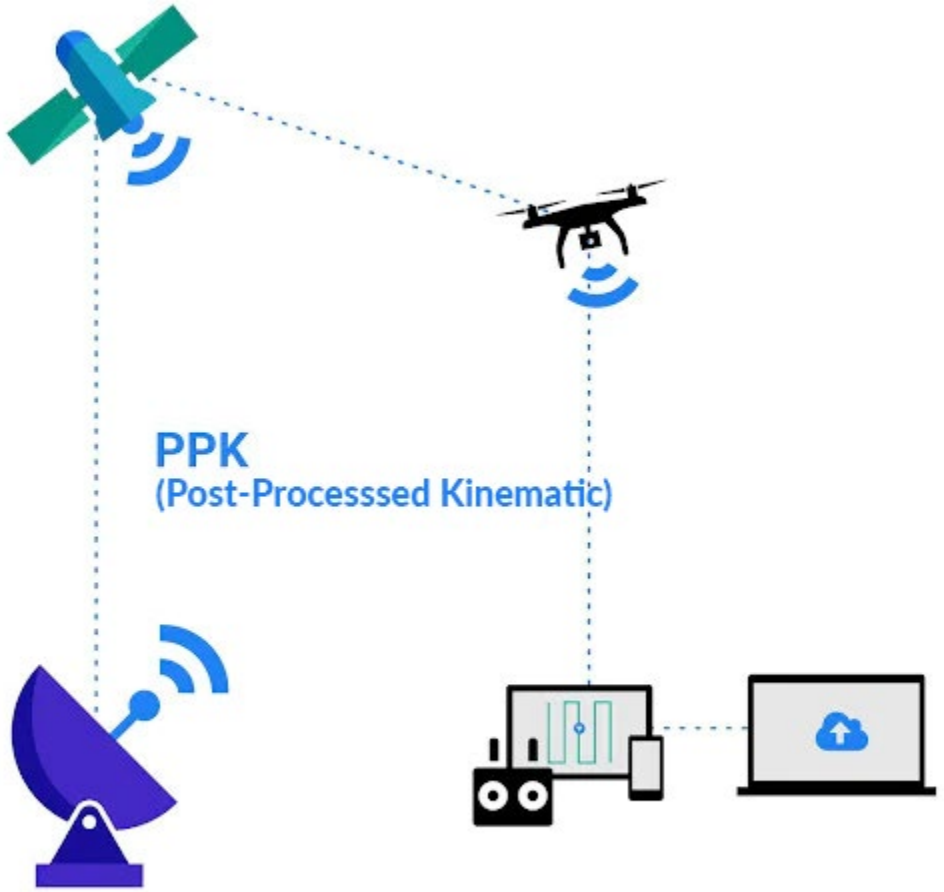
RTK – Real-Time Kinematic

Uses GPS and a known reference point to provide real time corrections to location data while the drone is capturing imagery. RTK requires a clear field of view to capture accurate data and may require a subscription.



PPK – Post Processed Kinematic

Similar to RTK, but the location data is updated after the drone has captured images, thus being “post-processed.” PPK an be used in crowded areas such as cities.



GCP vs RTK vs PPK

- For a small area, using GCP will capture high-accuracy data in the shortest time possible (without the added expense of purchasing an RTK or PPK platform).
- To map a large, wide-open area that's often changing, use an RTK drone.
- If you're flying in close quarters, in a crowded environment, or conducting a long-duration flight, the stronger signal strength from PPK imagery is recommended
- If you're looking for the best absolute accuracy, combine PPK images with GCP.

Any
Questions