Flight Controller and Ground Station Software

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Flight Modes vs Flight Plans

**Flight Modes**
- Determines flight behavior of copter and extent of operator control
- 14 built in flight modes
- Can be switched during flight

**Flight Plans**
- Applicable in the auto flight mode
- Pre-determined before takeoff and pre-loaded onto copter
- Generated with GCS user interface using interactive map
Flight Modes: Stabilize

• Most commonly used flight mode
• Pilot has control of vehicle’s altitude, pitch, roll and yaw
• Throttle is adjusted based on title angle of the vehicle
  – Increased vehicle tilt increases throttle sent to vehicle

http://ardupilot.org/copter/docs/stabilize-mode.html
Flight Modes: Stabilize

- When pilot releases control of pitch or roll, vehicle automatically levels itself with respect to horizon
- When pilot releases yaw vehicle maintains its heading

http://ardupilot.org/copter/docs/stabilize-mode.html
Flight Modes: Loiter

- Mode used to help automatically maintain an operator determined vehicle altitude

- Horizontal location can be determined by pilot input, but vehicle will maintain position once roll and pitch control sticks are released

- Altitude controlled by manual input
  - Vehicle will maintain altitude if throttle input is unchanged

- Vehicle’s yaw can be controlled by pilot

http://ardupilot.org/copter/docs/loiter-mode.html#loiter-mode
Flight Modes

Auto

• Begins the pre-programmed autonomous flight
• Allows manual yaw control but all other parameters are locked
• Requires GPS signal

Land

• Brings the copter straight down at it’s current location
• Usually used as a manual emergency land

http://ardupilot.org/copter/docs/flight-modes.html
Flight Modes

RTL (Return-to Launch)

- Automatically returns the vehicle to the take-off location and lands the vehicle
- Requires GPS signal

http://ardupilot.org/copter/docs/flight-modes.html
Failsafes

- Radio Failsafe: vehicle will return to launch if lost connection occurs during flight

- Ground Control Station Failsafe: vehicle will return to launch if lost connection occurs during flight (unless vehicle is in auto mode where mission will just continue)

- Software arming mechanism prohibits motors from operating until internal vehicle parameters are verified and operator manuals arms copter

http://ardupilot.org/copter/docs/failsafe-landing-page.html
Failsafe

• Manual Failsafe
  – Easily able to change into Land or RTL flight mode
  – Ability to take manual control of the vehicle
  – Switch on copter must be pressed before motors will arm

Image from: http://store.jdrones.com/v/vspfiles/photos/elepx2sw01-2.jpg
Ground Control Station: Overview

- **GCS used: Mission Planner**
- **Software interface that communicates with the vehicle over 915 MHz wireless telemetry**
- **System showcases real-time data from vehicle and provides interface to adjust vehicle parameters**
Ground Control Station: Overview

- Allows user to define autonomous flight plans and calibrate hardware
Ground Control Station: Heads-Up-Display

http://ardupilot.org/planner/docs/mission-planner-ground-control-station.html
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QUESTIONS?