



# SOFTWARE DEVELOPMENT FOR UNMANNED AERIAL SYSTEMS

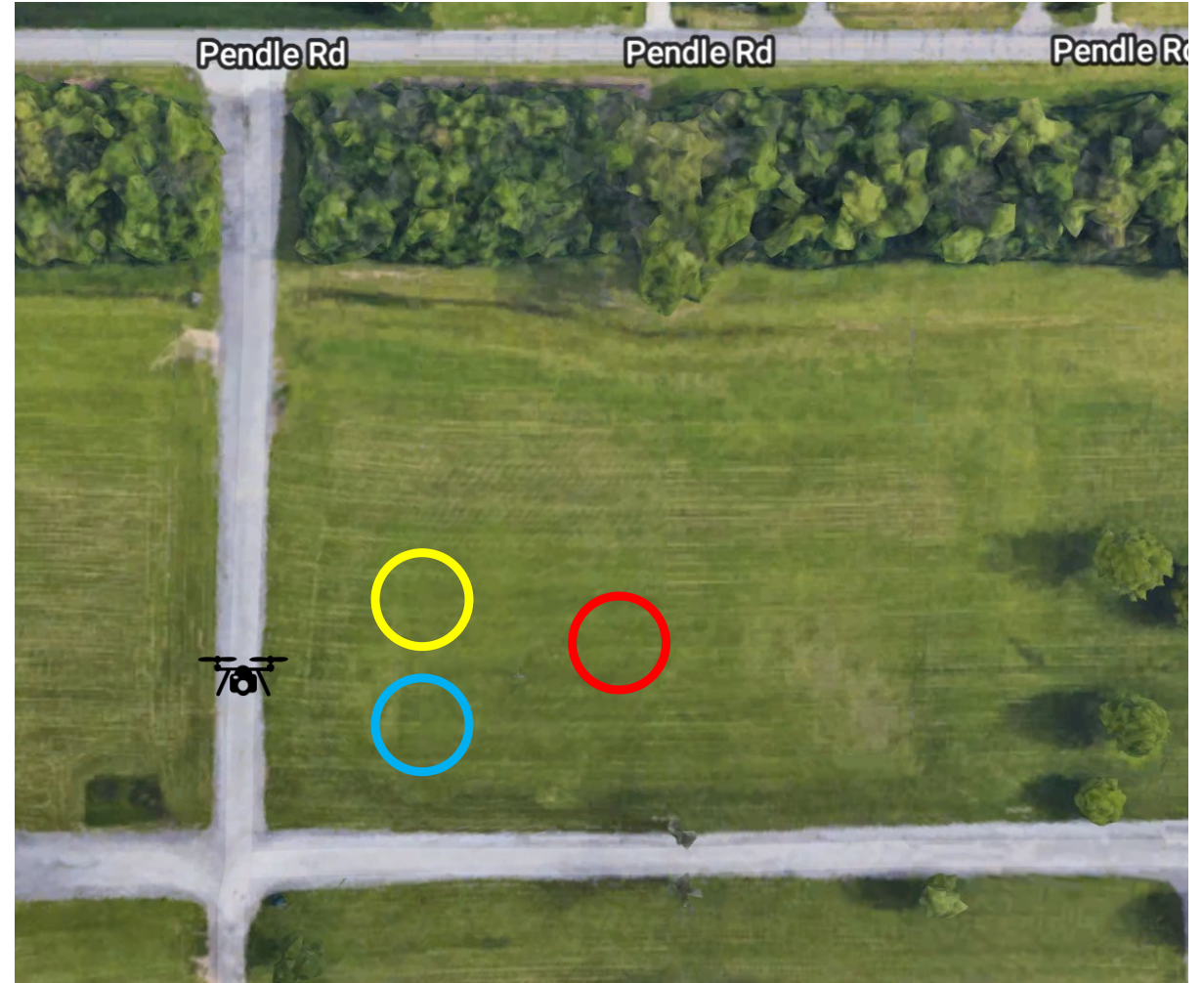


# Goals for Today's Class

- Getting ready for flying
- Testing your code
- UAV configuration & calibration
- Flying field safety
- Projects
- Group time + Safety Analysis Discussion

# Flying: Getting Started

1. **Flying training**  
(for those who haven't flown before).
2. **Flying test**  
(everyone) Includes flying from one hula-hoop to another.
3. **Simple python program**  
flying from your laptop.



Wednesday, Feb 27<sup>th</sup> 3.30pm-5.30pm or Wednesday, March 6<sup>th</sup> , 3.30pm-5.30pm

# Safety Issues



Identify hazards

Identify  
contributing faults

Specify mitigating  
requirements

Build a safety case

# Testing before flying!

- Run in the simulator before flying in the real world!
- Eyeball results – sanity checks!  
*Check the input data, expected results, expected outputs*
- Plot coordinates / Connect to the Dronology map
- Monitor data / log data & Analyze  
*Compare timestamps & distances, check log entries*
- UAV internal safety features – Use them, but don't rely on them!



# Class UAVs



## 3DR Iris

- Radio Telemetry (USB Dongle)
- Pixhawk Flightcontroller
- optional: Raspberry Pi
- optional: GoPro + Gimbal



## Intel Aero

- WiFi
- Intel Flightcontroller
- Built in companion computer (Ubuntu)
- Multiple cameras (Infrared, down/forward facing)

# Class UAVs



## Hexcopter

- Radio Telemetry (USB Dongle)
- Pixhawk Flightcontroller
- optional: Raspberry Pi
- can carry heavy stuff...

# Calibrate and configure your UAV



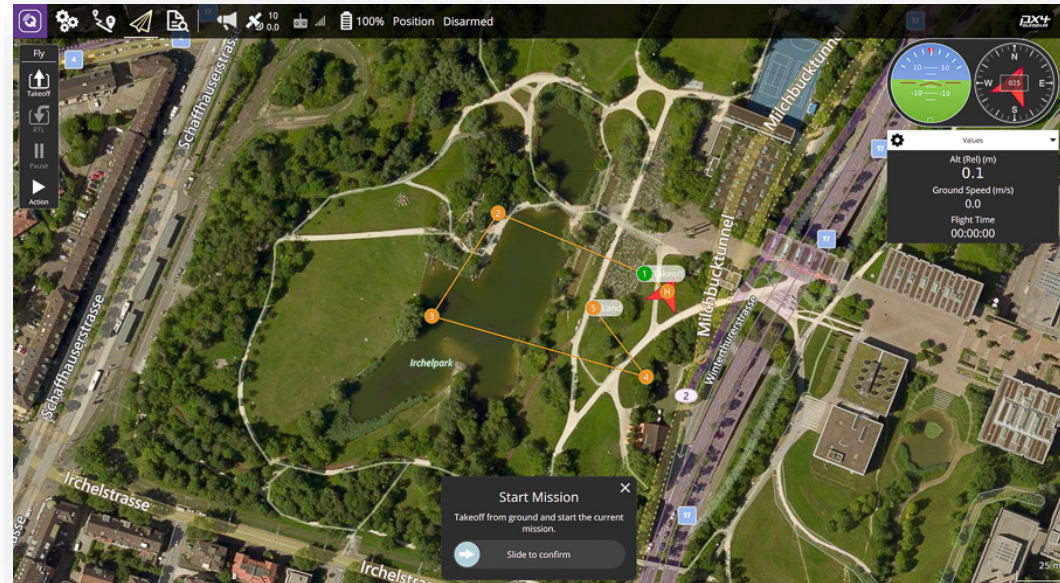
<http://ardupilot.org/planner>

Windows



<http://qgroundcontrol.com>

(Windows), Linux, Mac

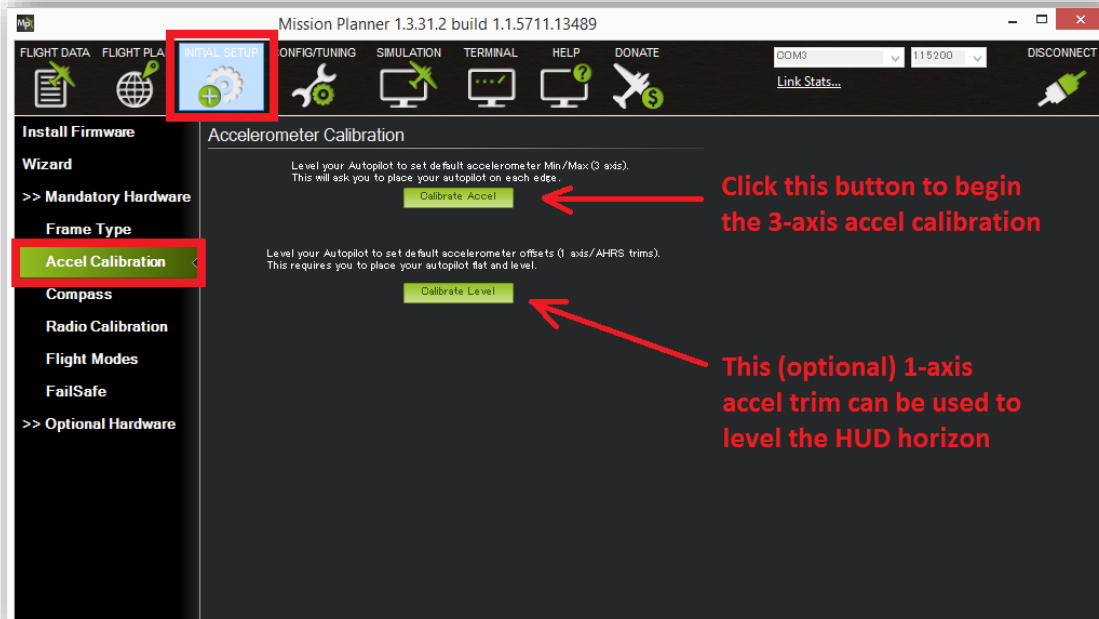




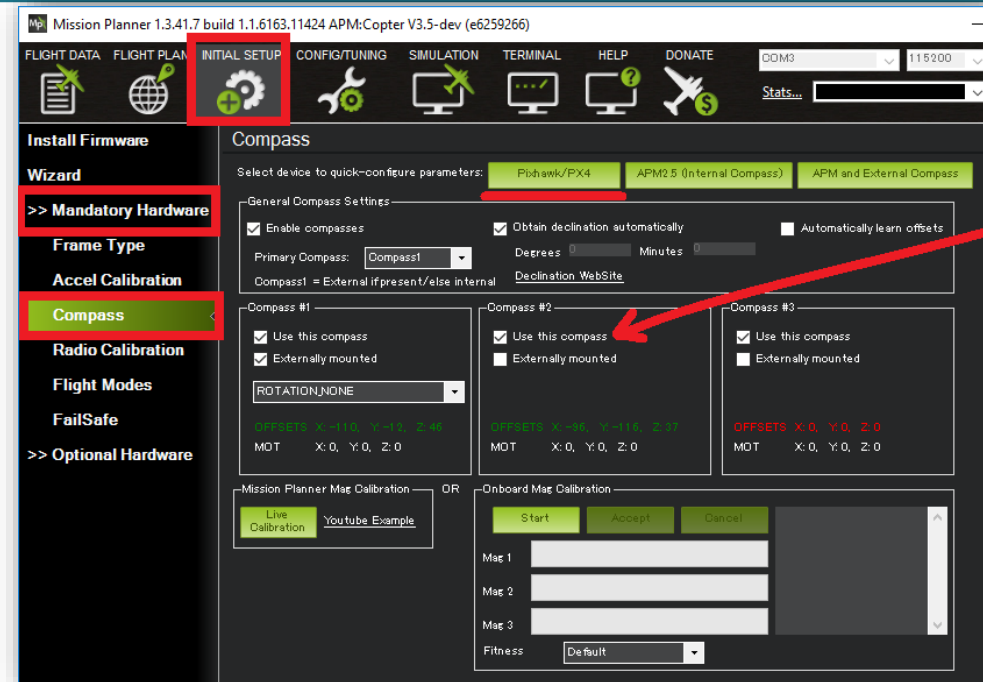
# Calibrate and configure your UAV



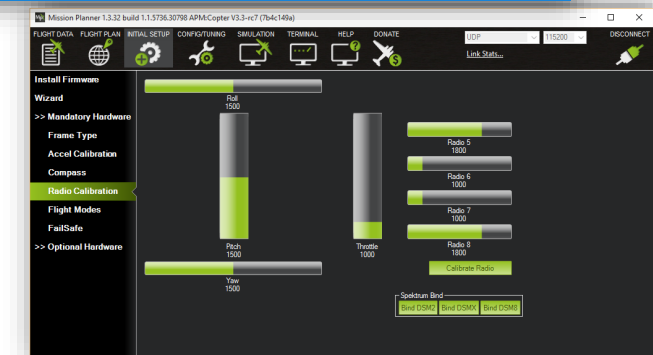
## 1. Accelerometer Calibration



## 2. Compass Calibration



## 3. Radio Control Calibration

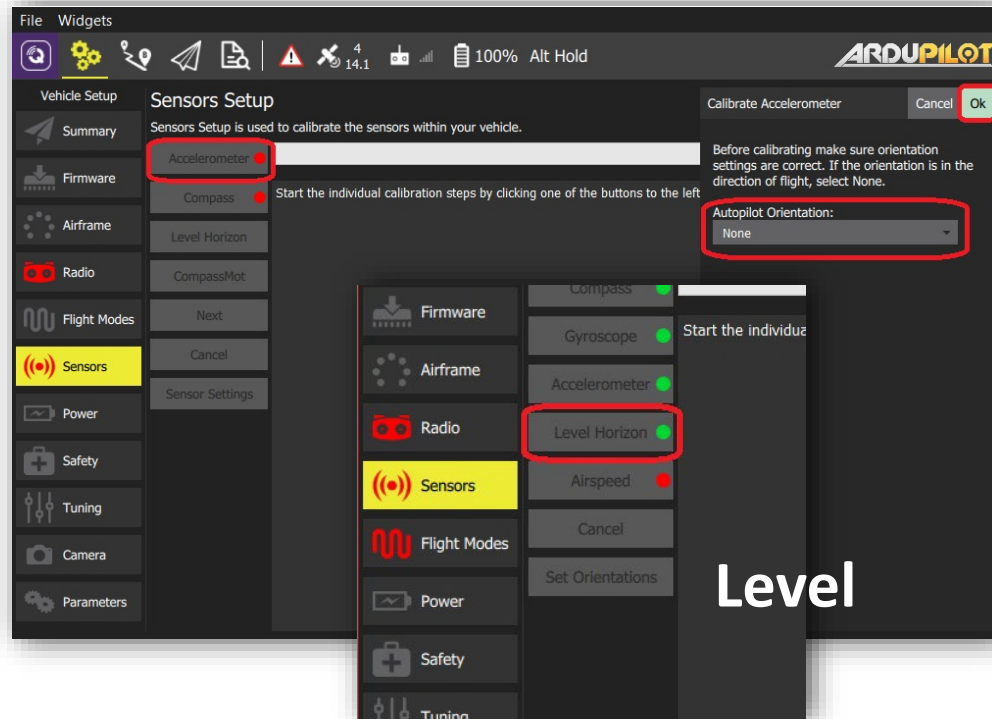


**User Guide:** <http://ardupilot.org/planner/docs/mission-planner-overview.html>

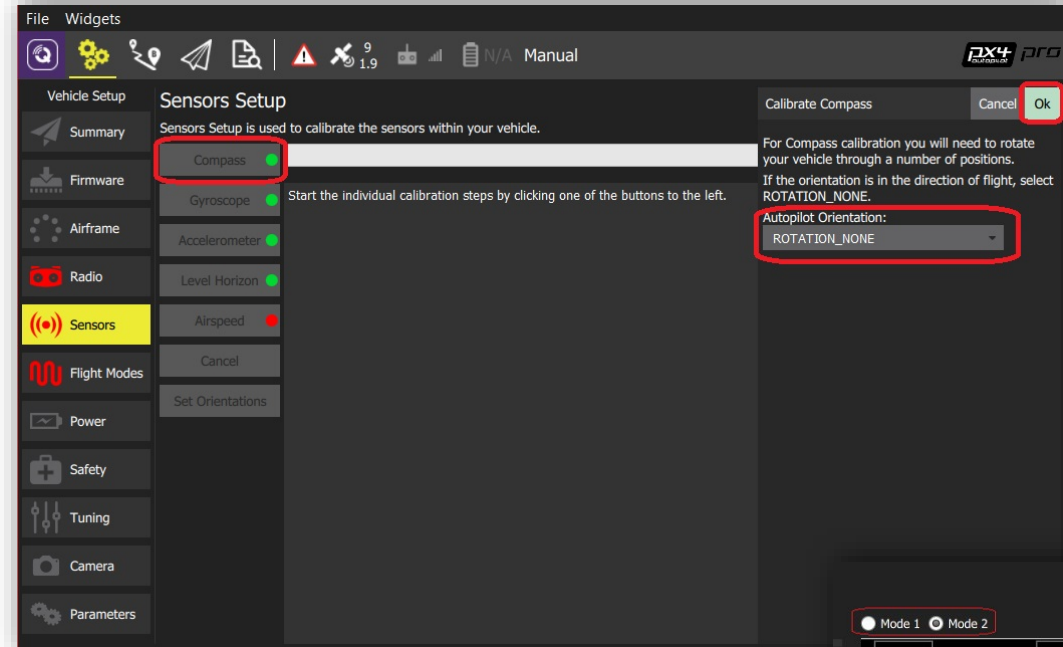
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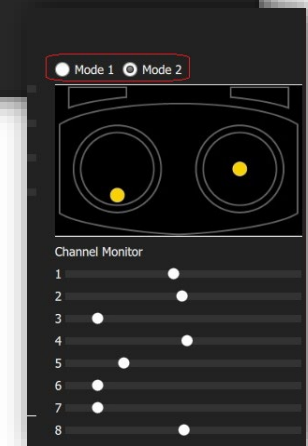
## 1. Accelerometer Calibration



## 2. Compass Calibration



## 3. Radio Control Calibration



User Guide: <https://docs.qgroundcontrol.com/en/>

# Flying Field

**Never fly over people!**

**1 Backup Pilot per UAV!**

**Test before fly!**

**Check UAV, batteries,  
handheld before you fly!**

**Don't panic! A broken  
(drone) arm is not the  
end of the world**



# Group Projects

## Topics!

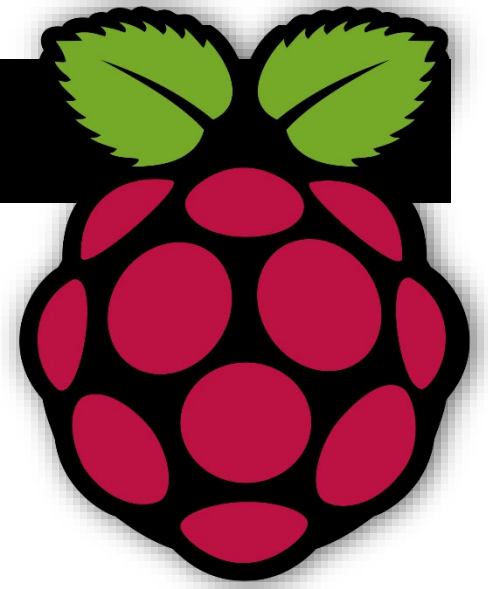
→ <https://goo.gl/UwVCzK>

- **Which UAVs?**
  - Do we need wifi, a pi, cameras, ...?
- **Additional Hardware?**
  - Sensors, servos, parachute, ...





# Pi Projects



- **Safety Analysis**
- **Drone-to-drone Communication**  
(Homework Part1)

