

Preliminary Design Review

Team Otto

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The Team



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People love capturing life's most exciting moments. Sometimes it can be tough.



The Observation

- Action sports are difficult to film
 - Additional camera operation
 - Distraction of holding camera



The Solution

- **Otto: The personal cameraman**
 - Quadcopter
 - Autonomous flight
 - FollowMe feature
 - Recording



The Impact

- Easier way for user to record themselves
- Gives user visual feedback
- Better quality video
- Improved safety for user



Requirements

1. User must carry smartphone and wear an extra article of clothing
2. User initiates drone takeoff and landing
3. User controls drone/user separation distance
4. User initiates and terminates FollowMe mode
5. User starts and stops video recording
6. Video recording is of high-resolution (720p or better) and has user in the frame

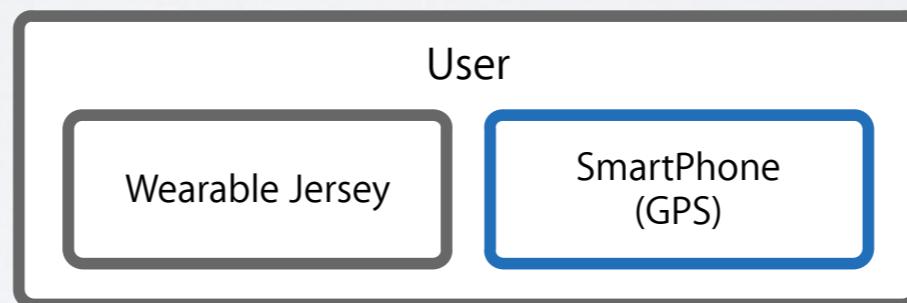
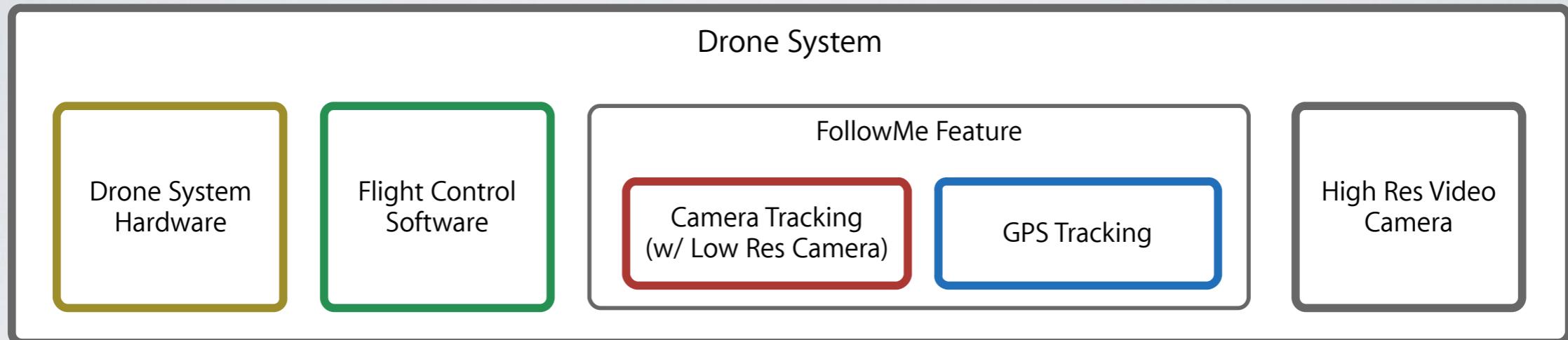


System Specifications

1. Maximum drone/user separation: 100 meters
2. Minimum drone/user separation: 5 meters
3. Average flight time: 10 minutes
4. Maximum speed of drone: 40 mph
5. Drone does not have to avoid obstacles
6. Drone can initiate emergency landing upon reaching critical battery level

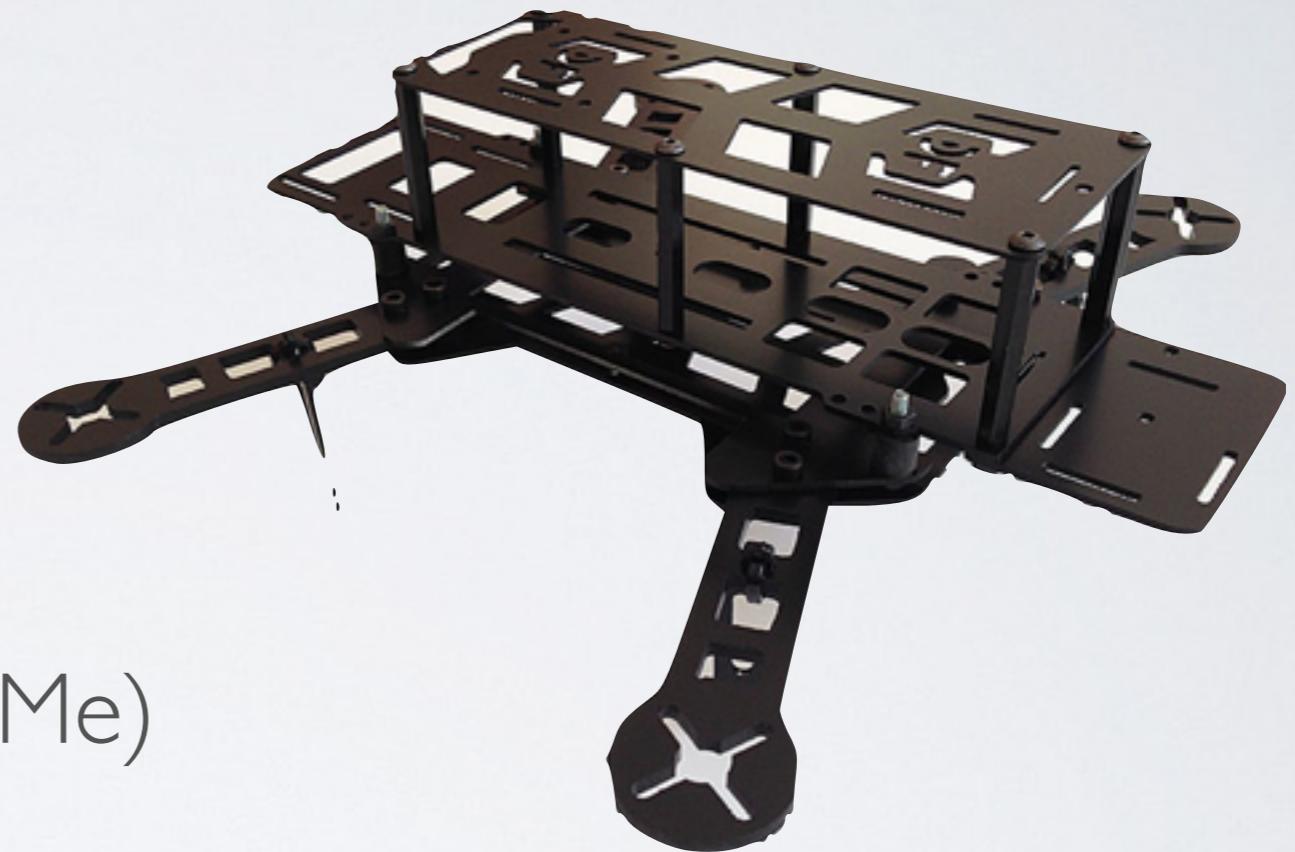


Otto Block Diagram



Drone System Hardware

- Purchased Components
 - Frame
 - Motors, propellers
 - Flight control board
 - Battery
 - Video cameras
 - Microcontroller (FollowMe)
- Designed Components
 - Interface board (FollowMe hardware)



Flight Control Software

- Level flight
 - Stable takeoff and landing
 - Maintain height
- Movement
- Interface with FollowMe
- Emergency landing



GPS Tracking

- GPS module on user and drone
- Establish a WiFi communication link
- Send processed positional information to the flight control software



Camera Tracking

- Use low-resolution video camera
- Perform color-based object tracking
- Send commands to flight control software



Design Alternatives

1. Use long-range bluetooth instead of WiFi
2. Use a wearable device in place of a phone for tracking
3. Physical tether
4. Use a planned flight path in place of the FollowMe feature
5. Use a single camera for both tracking and recording



MDR Deliverables

Drone System Hardware

Flight Control Software

GPS Tracking

Camera Tracking



Questions?



Backup Slides



Sensor Fusion

- Combine two tracking inputs
 - GPS is rough estimate
 - Camera Input is crisp locating
- The inputs will come together and send instructions to the flight control software
- This software will run on a microprocessor separate from the flight control HW
- It will be interfaced with the FCB with UART or I2C

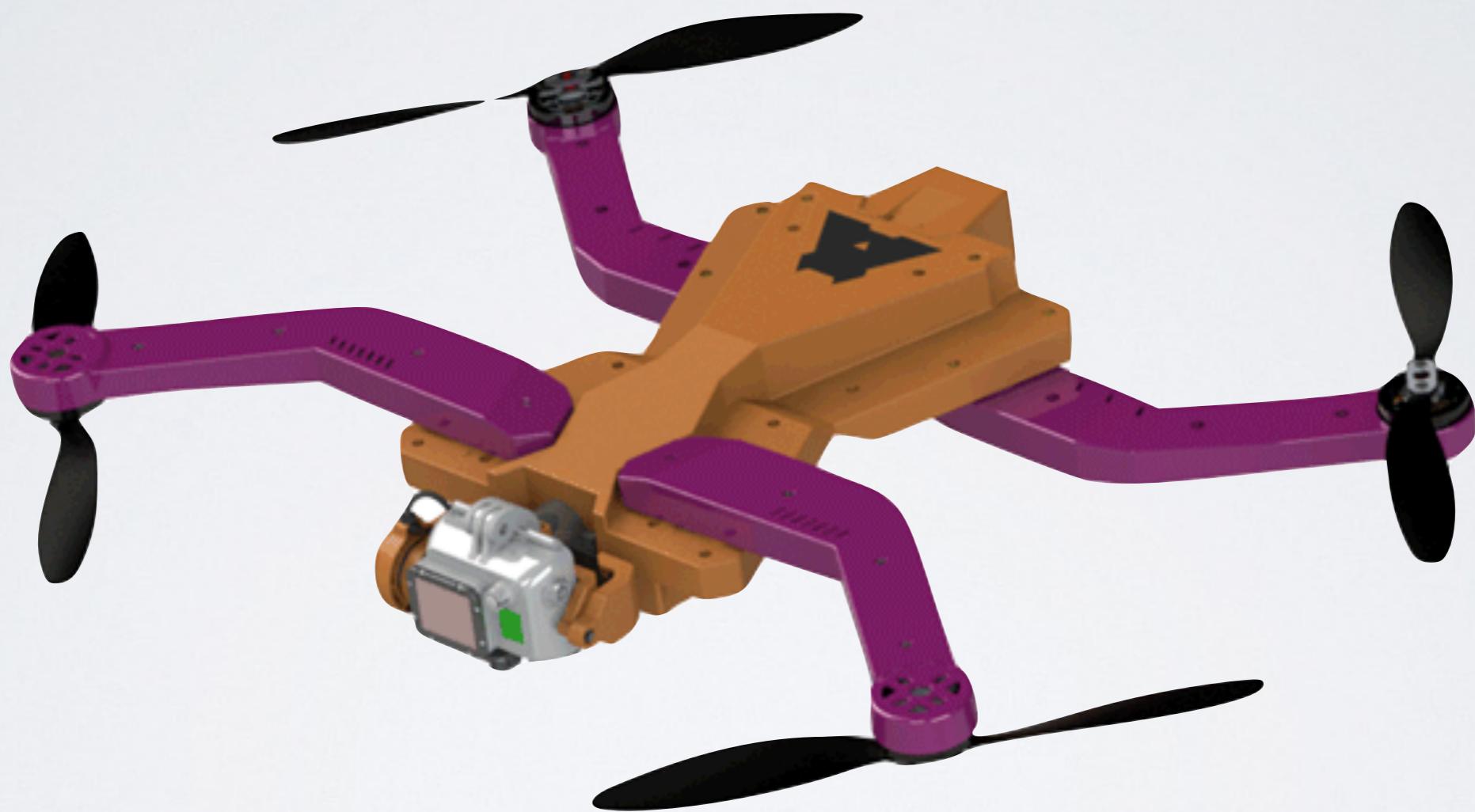


Stretch Goals

- Live video feed
- Camera tracking, no wearable jersey required
- Stabilize camera with a gimbal



Current Solution: AirDog



Current Solution: Hexo+

HEXO+



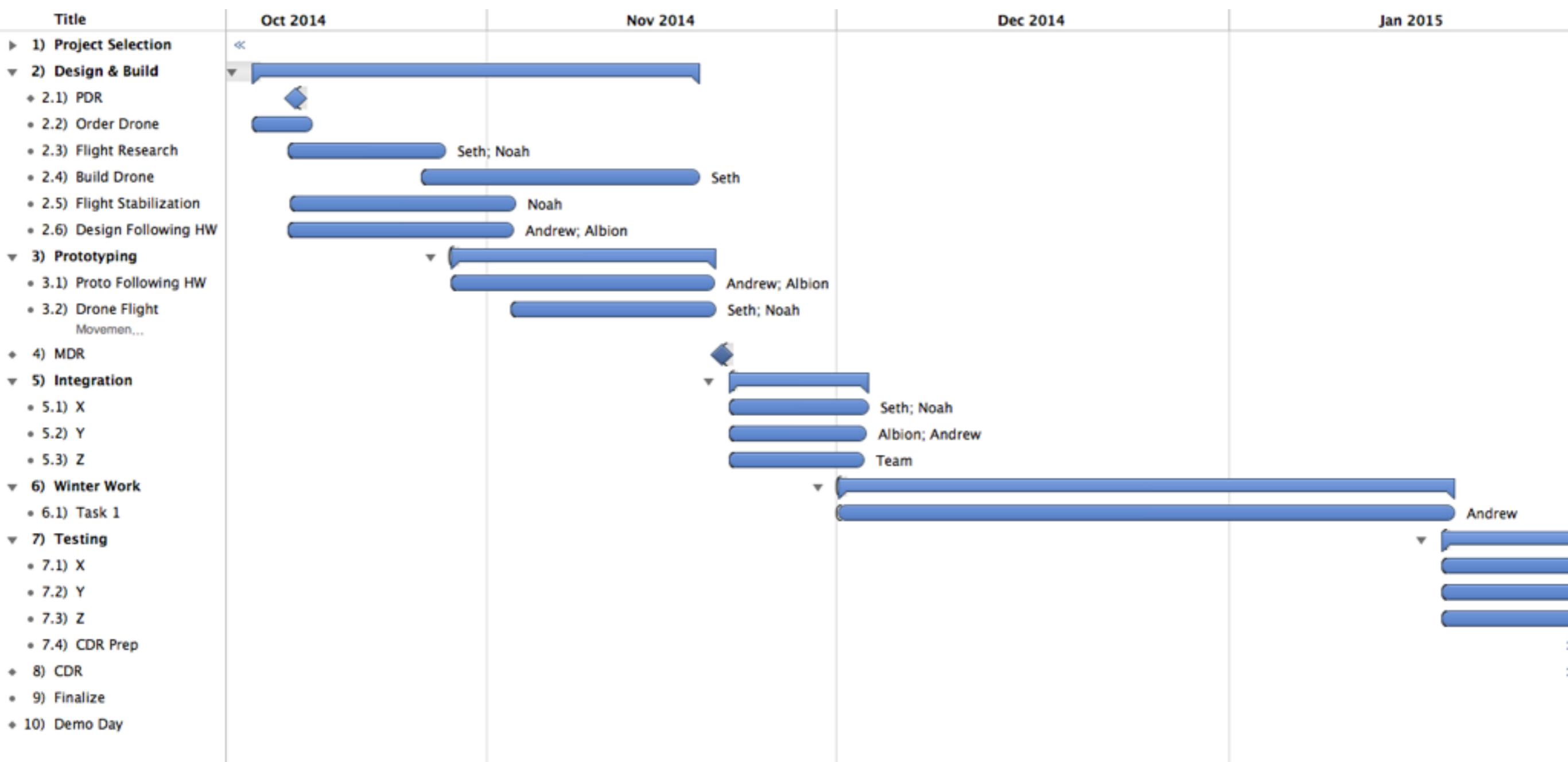
Current Solution: Iris+



Camera: GoPro Hero (2014)

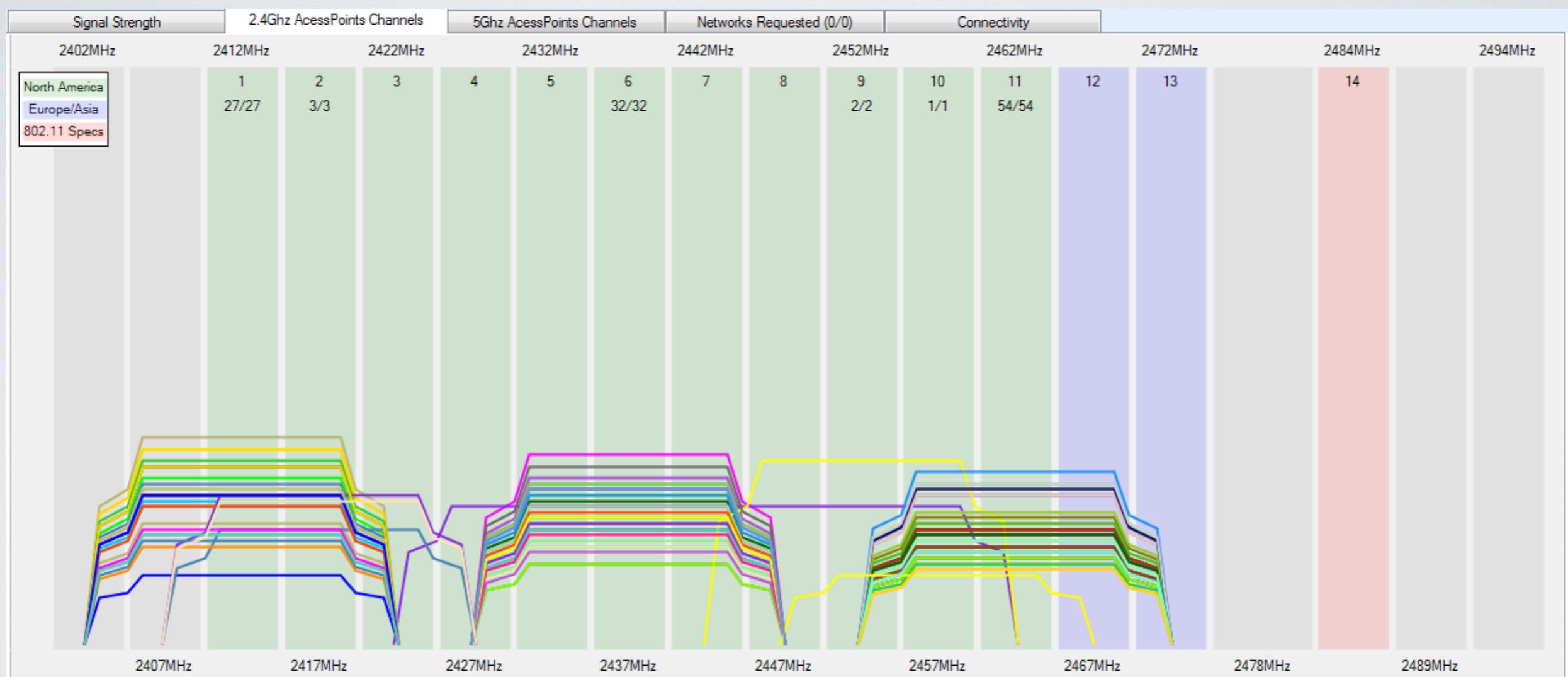


The Timeline



Wi-Fi Signal Strength in the Quad, using Acrylic Wi-Fi Free

2.4 GHz Spectrum



Color indicates a unique broadcast. Band height indicates signal strength (RSSI) in dBm.

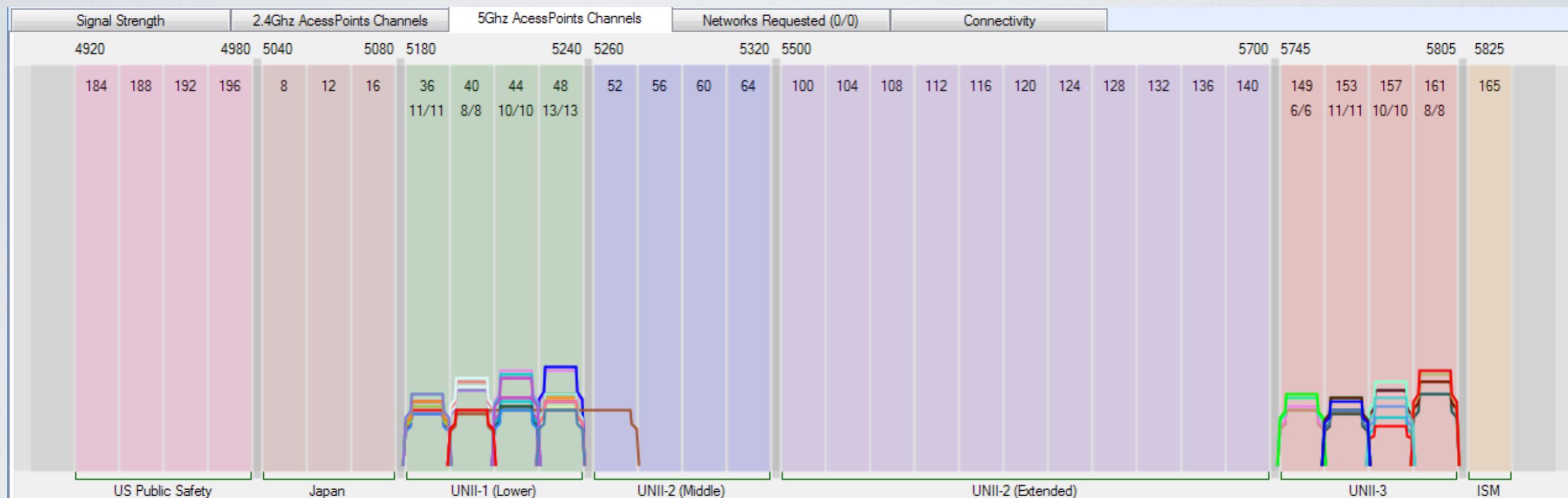
129 unique broadcasts in the 2.4 GHz spectrum (65.8% of total broadcasts)

Max RSSI for all broadcasts: -64 dBm

Min RSSI for all broadcasts: -88 dBm



5 GHz Spectrum



Color indicates a unique broadcast. Band height indicates signal strength (RSSI) in dBm.

65 unique broadcasts in the 5 GHz spectrum (33.2% of total broadcasts)

Max RSSI for all broadcasts: -75 dBm

Min RSSI for all broadcasts: -90 dBm



Drone Weight & Payload

Item	Price	Weight (g)	Notes
DRQ250 "Mini-D" w/ 6" prop arms	85	155	Has a dirty / clean design and location for camera. The design is supposed to help with stable & clean shot
Motors - SunnySky x2204s	100	100	Tested to provide 214g of thrust @ 50% per motor with HQ 6030 probs below
4x Props	8	20	6030 Carbon Composite Props (reccomended by frame)
ESC	32	80	Work with motors above, B-12A Ice Blue series SimonK-(RapidESC)
Flight Control	65	10	OpenPilot CC3D Flight Controller
Battery	40	310	30C 4000mAh 3S 11.1V LiPo Battery; should allow for 15-20 min (ideal)
GoPro	130	150	actualy about 76g (Hero)
GPS Module	79	2	
GPS Antenna GLONASS 9 M	79	10	Antenna for GPS / GLONASS; SMA connector; reccomended by ublox neo m8 series GPS Module
uController w/ WiFi (approx)	75	20	
WiFi Module	—	—	
Extraneous Parts	50	100	
TOTAL PRICE	743		
TOTAL WEIGHT	957		
Required Thrust / Motor	287.1	Achieved at about %60 thrust	

