

### **Flight Controller requirements**

- Flight controller should be supported by PX4 (Pixhawk Standard or Manufacturer Supported) - <https://px4.io/ecosystem/compatible-hardware/>
- RAM - Suggested 512KB RAM (At least 10% RAM needs to be free after the current DSS fw has been updated).
- SDcard - Good performance, durable.
- Recommended autopilots
  - CUAV NANO V5
  - mRO
  - CUAV V5
- External Compass
- DShot support
- Each flight controller should have unique serial number stored internally
- Flight controller should be supported by px4 1.13.x

### **GPS RTK**

- F9 GPS is highly recommended

### **Drone performance requirements**

- Flight time suggested minimum 20 min.
- Max speed and agility performance flight
  - Drone should be capable of doing 10 m/s horizontal, 6 m/s vertical up, 3-4 m/s vertical down (Performance dance path will be provided)
- Low wind flight performance - test wind less than 3m/s
  - Flight time when hovering (to be specified by manufacturer)
  - Flight time when moving with average X/Y/Z m/s (to be specified by manufacturer) speed
  - Max speed and agility performance flight (to be specified by manufacturer)
  - Dance altitude up to 100m
  - Dance distance from access point (AP) up to 300m
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- High wind flight performance test wind at least 8m/s
  - Flight time when hovering (to be specified by manufacturer)
  - Flight time when moving with average X/Y/Z speed (to be specified by manufacturer)
  - Max speed and agility performance flight (to be specified by manufacturer)
- Performance metrics to be met
  - Following the setpoint
  - Vibration levels should be below 0.04 at all times (could be verified review.px4.io see *note 1*)
  - GPS stability/eph/epv stability during flight
  - Max speeds

- Flight time
- Battery levels during flight - checking for possible underpower situations (not following setpoint/voltage sagging)

### **LED/Payload requirements**

- LED Brightness - Minimum 900 Lumens (to be defined) from Ym distance dark room
  - For R/G/B/W colors
- LED Control
  - Leds controlled through serial UART communication (custom payload)
  - 3-4 extra main PWM output - PWM Leds RGBW
  - 3-4 auxiliary PWM outputs - PWM Leds RGBW
  - In case Dshot is used, main PWM outputs can not be used for LED control.
- Strobe support - strobe max 15 Hz (to be defined)
- Firework support - pwm or serial uart

### **Communication link requirements**

- RC 2.4Ghz, (5.8Ghz, 433mhz, 868mhz)
  - One radio to one drone - to change drone, need to change profile
  - One radio to all drones simultaneously
- WiFi - 5ghz
- 2nd ch - 433mhz/868mhz/915mhz/Lora encrypted - mavlink supported
- Communication distance (on urban environment and open area) for
  - Primary channel at least 400m
  - Secondary channel 1200 m
- Provided network setup must be tested with 30-50% reserve of client connections
- Multiple AP configuration
- Mesh Network
- UDP to streaming to one GC port e.g. 14550
- WiFi speed requirement (with LogDownload in mind - at least 24kb/s)
- Remote WiFi profile customizable.

### **Future proof requirements**

- Remote Wake/Sleep functionality (battery is connected all times and drone is in standby consuming low power)
- Onboard computer - for DSS to be independent from flight controller firmware

### **Drone safety/construction requirements**

- AUW - drone weight needs to be kept in mind, that smaller weight and form factor will be easier to service and safer to fly. There needs to be compromise between performance and AUW
- Prop Guards - Should be strongly considered if the drone is being developed from scratch
- No sharp corners/spikes

- FastLanding support - drone does not explode after fast land - e.g. is not landing on battery first
- Possibility to remotely turn off engines for drones using a channel that is not going through the flight controller. Solution should be strongly considered if the drone is being developed from scratch
  - Either power to motors
  - Or signal to motor controllers
  - Another option
- Easy access of SDcard - in case for some issue investigation SDcard content is necessary
- Easy access of USB - **for connecting drone to pc**

### **Batteries and charging**

- Drones should use smart batteries (LiPo / Li-ion)
- Batteries should have very good fixation points so they are unable to accidentally disconnect during flight
- Batteries should have LED charge indicators that light up after pressing a button on them
- Drones should come with smart battery multi-chargers (at least 10 batteries per charger)
- Batteries should attach to drones and to chargers without the use of any cables, they should simply slide into the connector

### **Logistics requirements**

- All drones should have their IDs on them. These can either be stickers or plastic tabs with IDs that can be changed if needed.
- Drones should have a management software, allowing to update bootloader, firmware, IDs, IP addresses on the whole fleet simultaneously.
- Drones should be able to fit inside their storage / transport cases with the propellers mounted on them. Ideally there should be no need to use any propeller fixing tabs. If it makes the boxes bigger that's not an issue, main thing is that it should take as little time as possible to take a box and put the drones on the field.
- Drones should be stackable - this would make it easier to carry multiple drones together to/back from the field.

### **Requirements for manufacturing documentation**

- Quick user manual, user manual
- Have maintenance schedule described in user manual
- Provide testing and manufacturing process documentation (certification?)

### **Notes**

1. Vibration metrics - review.px4.com

