Drone Research: Parts Selection

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| Complete V1.0 | 15/9/2022 | Start, part list requirement |
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# Introduction

In this document all part requirements (for the new MRR conceptual drone) will be explained. The new drone will eventually be used for agriculture or logistic purposes, but the stakeholder made clear that the focus should be on agriculture applications whilst keeping logistics as a possibility. Besides that, the stakeholder also wanted a drone design that was like the drones made by the company *Tective Robotics* as they were a vendor for the stakeholder. So, this document will consist of individual drone part analysis, with the focus being one matching the parts of to the parts of the drones made by *Tective Robotics.* So, using this information one could buy are the parts required to build a high-end drone (for agricultural purposes) or make the choice of buying drones from the company *Tective Robotics.*

# Parts

The following is a list of individual parts that make up an entire rotor drone. This is the list of parts that will be researched in the following passages. The is as follows:

* Batteries – Power supply
* E-Motors – Motors that convert electrical energy into mechanical energy
* ESCs (Electronic Speed Controller) – Electronic circuit that controls & regulates E-motors
* Propellers – A mechanical device for propelling boats and aircrafts.
* GPS – Global positioning system
* Telemetry – Radio communication device that transmits drone data to operators.
* Frame – What holds everything together on a drone

## Batteries

Problems

* Low flight-time (15 min)

Solutions

* Increase battery capacity
* Lower drone weight

Extra

* Stakeholder wanted to make the switch to 6s (22.2V)

Requirements result

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| **Requirement:** | **Value:** | **Reasoning:** |
| Capacity | 10000 mAh or higher | Drone will be used for agricultural purposes, so flight time should be high as the fields are generally large. |
| Voltage | 6S (22.2V) or higher | Stakeholder requirement |
| Weight | 2.5 Kg or lower | Weight should be kept to the minimum seeing that it also affects flight-time. |

The **Tattu 16000mAh 22.2V 30C 6S1P Lipo Battery Pack with AS150+XT150 plug**, was the optimal choice for batteries as it had a high capacity, low weight, price & as a bonus it is already being used for existing agricultural drones.

## Motors

*Tective Robotics* Meeting take-away

* Motors with 350Kv are more than enough for the stakeholder’s application (agriculture)
* Motors from *Tmotor* are good options for drone development

Requirements result

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| **Requirement:** | **Value:** | **Reasoning:** |
| Constant Velocity (KV) | 350Kv or lower | *Tective Robotics* advice |
| Operating voltage | 6S (22.2V) or higher | Batteries are 6S |
| Weight | 250g or lower | Weight should be kept to the minimum seeing that it also affects flight-time |
| Type | Navigator | The drone will be used for agricultural purposes. This motor type is made for maximum stability (that is why is used for film drones). |
| Company | TMotors | Stakeholder requirement/ *Tective Robotics* advice |

The **MN5208 KV340**, was the optimal choice for the motors as it was the motors that were being used by *Tective Robotic*s (Not a fact, but based on the KV values mentioned during the meeting and the look of the drone on their webpage it was determined that this was the motor being used), had the lowest, weight, was of navigator type and had 6S support.

## ESCs

Alpha variant choice reasoning

* Recommended by *TMotors*
* Recommended for U/Navigator-type motors (<https://www.helipal.com/products/t-motor-esc-t-motor-alpha-60a-lv-esc> )
* Other options on from *TMotor* were outside of the voltage cap, meaning that the ESCs could not control the motors or the ESCs was overkill.
* Better response time

A link to a list of possible Alpha ESCs was put in the excel sheet, this list shows exactly what is needed for the specific motor that will be/is being used. For the **MN5208 KV340** it is recommended that an **ALPHA 40A 6S** be used.

## Propellers

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| **Requirement:** | **Value:** | **Reasoning:** |
| Length | 16 inches | Recommendation for 350 KV motors. |

## GPS

Problem

* Drone did not always land right due to faulty position data

Solution

* Increase accuracy

Result

|  |  |  |
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| **Requirement:** | **Value:** | **Reasoning:** |
| Type | High precision | Maximum precision so position data is more accurate. |
| Company | Ublox | Stakeholder requirement/ *Tective Robotics* advice |

The **Neo-M8P** a high precision module being used in photography drone& **ZED-F9P** a high precision module with built-in IMU (Inertial Measurement Unit, body force measurement) where determined to be the best modules for the drone. However, the stakeholder needed to contact the company for the prices. A budget of 500 euros was used instead of the actual prices.

## Telemetry

Not a lot of research was put into this part as there was another working on it already.

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| **Requirement:** | **Value:** | **Reasoning:** |
| Communication Protocol | UART | Stakeholder Requirement |
| Communication type | Full duplex | Stakeholder Requirement |

The **RFD 868X EU** set was selected because it met all the requirements of the stakeholder.

## Frame

For the purpose of fast estimation, it was determined that carbon tubes prices would replace frame price as this material was a staple in drone frame development. A trusted carbon vendor based in the EU was selected and documented in the excel sheet for this part.

# Conclusion

In the Excel-sheet you will find an estimate of the drone. Using this information one can conclude if purchasing or building would be more worth it.

# Summary

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| <https://www.tytorobotics.com/blogs/articles/a-guide-to-lithium-polymer-batteries-for-drones> | |
| <https://www.getfpv.com/learn/fpv-essentials/making-the-move-from-4s-to-6s/> | |
| <https://uavsystemsinternational.com/products/aurelia-x6-standard> | |
| https://matmatch.com/resources/blog/what-are-drones-made-of/#:~:text=If%20we%20use%20a%20Matmatch,make%20light%2C%20rigid%20drone%20frames. | |
| <https://www.researchgate.net/publication/331813111_Design_and_Analysis_of_3D_Printed_Quadrotor_Frame> | |
| <https://www.getfpv.com/learn/fpv-essentials/manufacturing-your-first-fpv-drone-frame/> | |
| <https://www.u-blox.com/en/casestudies/rtk-gnss-high-precision-drone-navigation> | |
| <https://novatel.com/products/gps-gnss-antennas/high-precision-gnss-gps-antennas?utm_source=UST&utm_campaign=Unmanned_Systems_Technology> | |
| <https://www.knowsize.com/dji-flame-wheel-f550-size/electronics> |  |
| <https://www.helipal.com/products/t-motor-esc-t-motor-alpha-60a-lv-esc> | |