

EXPERIMENT NO.: 2

Aim: Study of MAH Battery capacity with flight time calculation and battery connection.

Theory: MAH means milliamp Hour and is a unit that measures (electric) power over time. It is commonly used to measure the energy capacity of a battery. In general, the more MAH a battery has the longer the battery capacity or battery life. The capacity of Battery is measured in milliamperes x hours (MAH). For example if a battery has 250 MAH capacity and provides 2mA average current to load. In theory the battery will last 125 Hours.

To calculate flight time, take the battery's capacity in amp hours, then divide that into the average amp draw of the quadcopter and then multiply it by 60. The total is the flight time in minutes.

Methodology:

1.) Are Lipo Battery safe?

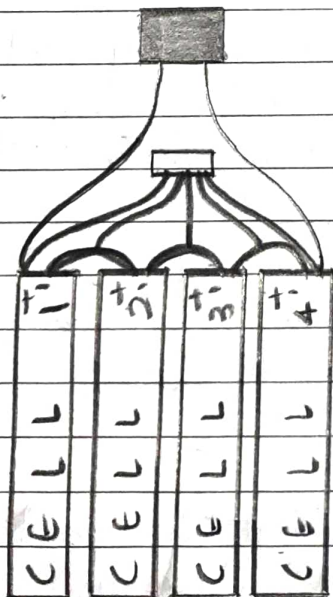
There are many reasons why LiPo batteries might catch on fire. That tends to only happen when you don't handle them properly or when they are physically damaged.

2.) The Basic about lipo Batteries for Mini Quad:

Lithium Polymer Batteries (LiPo) have high energy density, high discharge rate and light weight which make them a great candidate for RC applications. By learning the basic about LiPo batteries, you will be able to read and understand their specifications.

3.) Battery Voltage and cell count (c):

LiPo batteries exist in alls, each LiPo cell has a nominal voltage of 3.7V. If higher voltage is required, these cells can be connected in series to form a single battery.



4S LiPo



2S LiPo

We don't normally refer to the battery voltage, but how many cells in the battery, & how many "s".

$$1s = 1 \text{ cell} = 3.7V$$

$$2s = 2 \text{ cells} = 7.4V$$

$$3s = 3 \text{ cells} = 11.1V$$

$$4s = 4 \text{ cells} = 14.8V$$

$$5s = 5 \text{ cells} = 18.5V$$

$$6s = 6 \text{ cells} = 22.2V$$

Voltage after brushless motor RPM directly, therefore you could use higher all count batteries to increase your quadcopter's speed if your ESC and after electronic support higher voltage.

LiPo battery is designed to operate within a safe voltage range, from 3V to 4.2V. Discharging below 3V could cause irreversible performance lost and even damage to the battery.

4.) LiPo Battery capacity and size:

The capacity of a life battery is measured in mAh (milli-amp hours) "mAh" is basically an indication of how much current you can draw from the battery for an hour until its empty.

Increasing the battery capacity might give you longer flight time, but it will also get heavier in weight and

larger in physical size. There is a trade off between capacity and weight, that affects light and agility of the aircraft. Higher capacity could also give you higher discharge current

$$1000 \text{ mAh} = 1 \text{ Ah}.$$

5.) C Rating (Discharge Rate)

LiPO batteries for quadcopters these days all come with a C rating by knowing the C rating and capacity of a battery.

C-Rating is yet another crucial aspect that need to be checked before you decide to settle for any battery for your quadcopter. Batteries with an extremely low discharge rating often result in under-performance. You need to get a battery whose C rating is convenient for your quadcopter.

If C Rating is too low, the battery will have a hard time delivering the current to your motors, and quad will be under powered. It could even damage the battery if current drawn exceeds safety ratings, when C rating is higher than what's required, you won't gain much performance improvements.

6.) Flight Time Calculations:

$$\text{Quadcopter flight time} = (\text{Battery capacity})$$

* Battery discharge / Average AMP draw) * 60

a) Battery Capacity: For calculation you have to take the battery's capacity in amp hours.

b) Battery Discharge: It's common charge practice to not discharge your LiPo batteries below 20% mAh during flight; the effective capacity is only 80% that can be used during flight time.

For ex, 18 Ah * 0.8 = 14.4 Ah

c) Average AMP Draw: Before quadcopter battery calculator it is a must to find out the average amp draw, the thing which must be kept in mind is parameter of quadcopter motor.

For example.

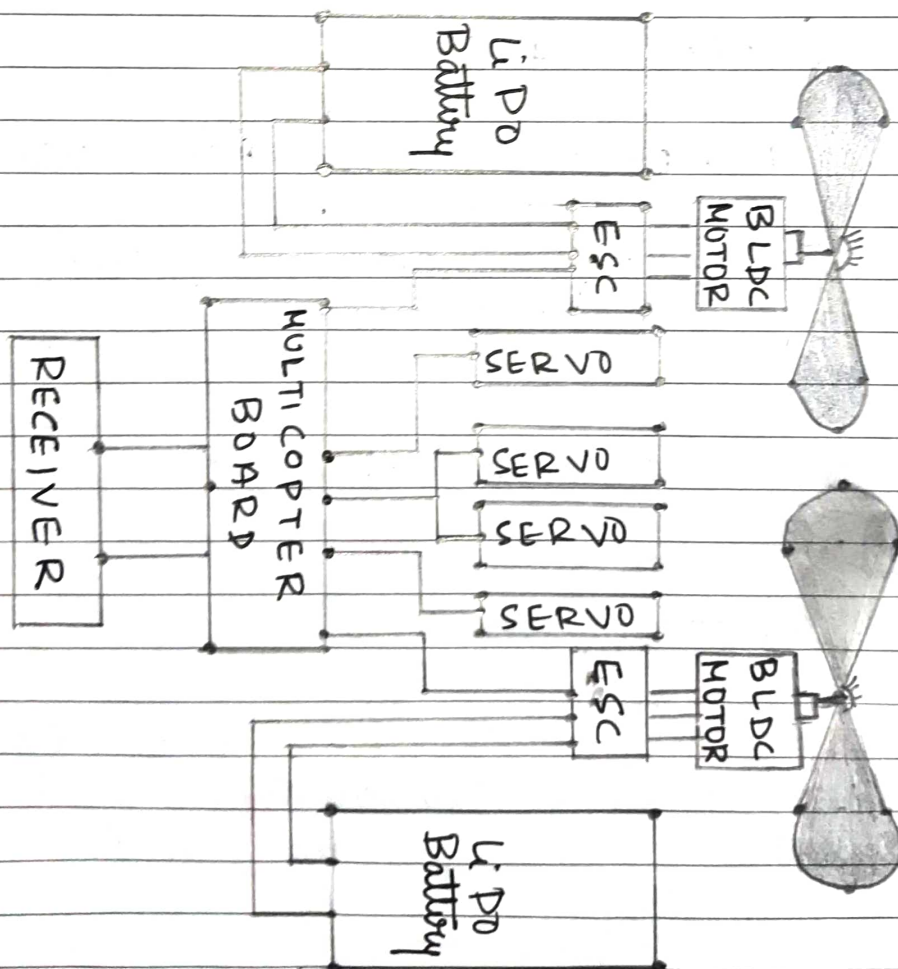
Quadcopter flight times = $(3300/1000 \text{ mAh}) * 80\% / 20 \text{ amps} * 60 \text{ mins}$

B] Battery Connections:

- 1.) Connectors: There are several Battery connectors, the entire process of soldering battery connections can be tiring and hectic at times. It is always a good idea for one to maintain a given connector type.

There are several type of connector that we can use for example 15 connector type, 25, 3B and 45 connector types.

- 2.) **Connection:** It's always important to fly with a full battery. Since the battery will fit comfortably in between the upper and lower frame. Use zip ties or velcro straps to hold the battery in place. It is very important that battery does not fall off the craft during flight.



Summary: In this experiment, the study of mAh battery capacity with flight connection has been carried out. We have even learnt about mAh battery calculation and flight time calculation. We have even learnt about the battery connection with the system using power distribution system.