Battery selection for Hexa Copter drone

Some important parameters to determine the ideal battery for our drone:

BATTERY VOLTAGE:

The nominal (Avg.) voltage of a LiPo cell is 3.7v. In fully charged condition it provides 4.2v, in discharged condition it gives 3.2v. In order to increase the voltage multiple Cells are used together. The number of cells used in a LiPo pack is shown by a number followed by the letter 'S'. A 4S LiPo can provide 14.8v.

How many cells are required in a battery, it depends upon the weight of the drone. Voltage affects brushless motors RPM directly, therefore we can use higher cell count batteries to increase our Hexacopter's speed

BATTERY DISCHARGE RATE:

The discharge rate is shown by a number followed by the letter 'C', the higher the discharge rate, better the performance. The discharge rating shows how quickly you can safely discharge your battery.

In other words, how much current you can safely pump to your drone without degrading the battery.

A higher C rating means that you will use less throttle input to get your craft to hover.

There is a phenomenon known as 'Voltage Sag' - The higher your throttle input, the faster you deplete your battery, but this depletion is not linear. At very high throttle the voltage drops even faster, but as you decrease throttle, the voltage will recover, the lower the C rating of your battery the more pronounced the voltage sag will be, and the longer it will take for the voltage to increase again.

With a high C rating, the voltage drop at very high throttle will be reduced. we should be looking at C ratings of 80-100C and higher for racing purpose.

Discharge rate(C) = current of Discharge/Rated capacity(mAh)

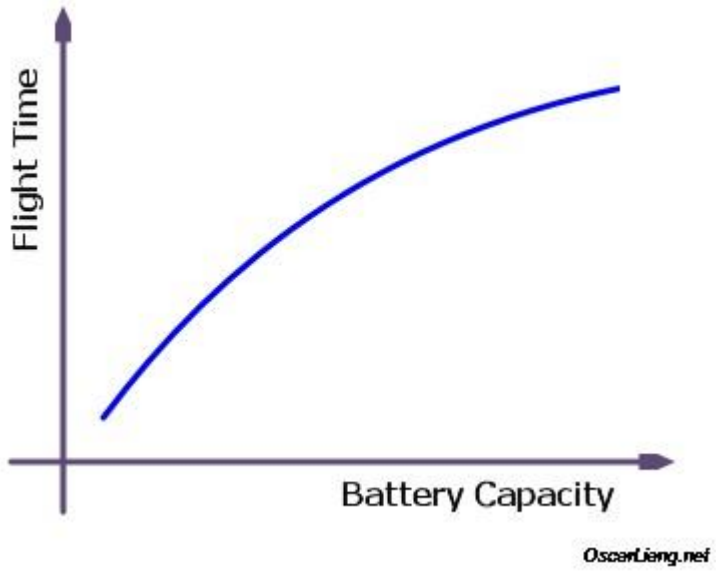
CAPACITY: (mAh)

The capacity of a LiPo has the greatest effect on flight times, the higher the capacity, the longer the flight time you will get from your craft, but also the higher the capacity, the heavier the battery will be.

In other words, it would take an hour to be completely discharged if you draw a constant current from it.

The capacity of the battery tells how long a battery can pass energy to the drone.

Lipo battery's higher energy density offers longer range and endurance, other than its lightweight and super-fast charging rate.



As the battery gets larger, the increase in flight time becomes ineffective. Eventually it will reach a point where it just doesn't gain any more flight time with bigger battery (even lose flight time). This is mainly caused by the weight of the battery.

As we are using TMOTOR MN5212:

DATA SHEET:

Item No.	Volts (V)	Prop	Throttle	Amps (A)	Watts (W)	Thrust (G)	RPM	Efficiency (G/W)	Torque (N*m)	Operating temperature (℃)
MN5212 KV340	24	T-MOTOR 15*5CF	50%	3.3	79.0	745	3821	9.44	0.142	38 ℃
			55%	4.2	99.8	910	4220	9.11	0.172	
			60%	5.2	123.6	1075	4576	8.70	0.198	
			65%	6.3	150.7	1254	4925	8.32	0.232	
			75%	9.1	217.2	1681	5663	7.74	0.31	
			85%	12.2	292.1	2115	6315	7.24	0.382	
			100%	17.8	426.7	2746	7167	6.44	0.498	
		T-MOTOR 16*5.4CF	50%	3.9	93.4	942	3767	10.09	0.187	49℃
			55%	5.1	121.2	1145	4130	9.45	0.227	
			60%	6.2	149.3	1338	4510	8.96	0.261	
			65%	7.8	188.2	1560	4862	8.29	0.303	
			75%	11.1	266.2	2110	5565	7.93	0.405	
			85%	15.2	363.8	2648	6217	7.28	0.509	
			100%	21.6	518.2	3445	7063	6.65	0.66	
		T-MOTOR 17*5.8CF	50%	4.7	112.3	1095	3651	9.75	0.225	53℃
			55%	6.0	144.2	1320	4017	9.15	0.27	
			60%	7.8	187.4	1625	4432	8.67	0.331	
			65%	9.6	230.2	1875	4772	8.15	0.381	
			75%	13.7	327.6	2363	5390	7.21	0.49	
			85%	18.1	434.6	2871	5960	6.61	0.593	
			100%	26.1	626.9	3716	6660	5.93	0.761	
		T-MOTOR 18*6.1CF	50%	5.7	137.5	1318	3596	9.58	0.29	74℃
			55%	7.4	178.1	1612	3958	9.05	0.344	
			60%	9.3	222.0	1901	4310	8.56	0.411	
			65%	11.6	278.2	2259	4622	8.12	0.472	
			75%	16.5	395.5	2835	5226	7.17	0.605	
			85%	22.1	531.1	3477	5751	6.55	0.737	
			100%	31.0	744.7	4355	6358	5.85	0.918	
Notes:The test condition of temperature is motor surface temperature in 100% throttle while the motor run 10 min.										

Flight time = approx. (30 mins)

No. of cells = 6S

Discharge rate = 80%

All up weight = 10kg (approx.)

Battery Voltage = 3.7 * 6 = 22.2v

For PROP SIZE: 18*6.1 CF

Here we compute the power to lift 1 Kg weight at 100% throttle by using the thrust and watts for 100% throttle of T MOTOR.

```
int
main ()
{
  // for propeller size 18*6.1 CF
  int t;
  cin >> t;
  while (t--)
    {
      float i, capacity, dsr, x, acd, tv, fot, wt, pw, noc, thrust, wattTmot;
      fot = 0.5;        // time of flight in hrs
      wt = 10;          //total all up weight in kg
      dsr = 0.8;        //80% is discharge rate
      // for 100% throttle

      thrust = 4.355;       //in kg
      wattTmot = 744.7;
      pw = wattTmot / thrust;   //power to lift 1 kg wt
```

Here we take input as the cell count and using that input we compute the voltage.

Then, we compute the Average amp(current) draw.

```
31
32      cin >> noc;       //no of cells for battery
33      float nv = 3.7;       //nominal voltage of a battery
34      tv = nv * noc;        //total voltage
35      i = pw / tv;      //current
36      acd = wt * i;     // calculation of Average current draw
37
38      x = acd / dsr;
39      capacity = fot * x * 1000;    //final capacity in mAh
40      cout << capacity << endl;
41    }
42  return 0;
43 }
44
```

And by using that we compute the required capacity(mAh) for our drone.

```
6
48141.6
7
41264.2
8
36106.2
```