



Power System Selection: *The TOC 33% Yak-54 3D.*

1: Calculate the power required: Because I want this airplane to have good vertical and 3D aerobatic capability, I choose *200 W/LB*. Likewise, because the airplane will weigh roughly *20LBS*, I choose a power level of 4000 watts.

2: Select number of LiPo cells: Here are the currents (Amps) required for each number of LiPo cells:

- 10-cell, 37.0V = 108 Amps
- 11-cell, 40.7V = 98 Amps
- 12-cell, 44.4V = 90 Amps



The amps required with the 10-cell pack is too high for most motors to run efficiently, and the 11-cell battery will allow me to turn a larger prop than with the 12-cell battery, so I will use the 11-cell LiPo battery for initial testing.

3: Calculate K/V: Because I want to spin a big, slow prop to get lots of thrust, I limit the RPM to 5000. The motor will spin significantly slower when loaded, so I increase this rpm by 20%, then calculate the RPM per Volt of the motor: $6000\text{RPM} / 41\text{V} = \underline{146 \text{ K/V}}$

4: Select ESC: This is probably the easiest step. All I need is a brushless ESC that can handle 98 (or more) amps with an 11-cell LiPo pack. This ESC will not have a built-in BEC, so I choose an 8-amp external BEC to power the servos and receiver.

5: Select Battery: Because I will be using full power for bursts (hovering, vertical, ect..) I want a battery that will be small in capacity but high in discharge current. Because a 20C battery is fairly inexpensive, I start with 5000mAh battery (20C X 5AH = 100A). However, a larger battery may be required to balance the airplane and get slightly longer flight times.

6: Estimate Flight time: For an aggressive flight, I can assume an average power level of 80 Watts / Pound, which gives me a average power of (80Watts/Lb X 20Lb) = 1600 Watts, which corresponds to 40Amps on the 11-cell battery. Divide 5 Amp-Hours by 40 Amps to give 0.125 hours = 7.5 minutes flight time.

Final Setup:

- **Motor:** 4000-Watt, 150 K/V
- **ESC:** 100+Amp Brushless, that will handle a 11-cell LiPo
- **Battery:** 5000mAH 20C 11-cell LiPo