Problem Statement :

An RC airplane is to be designed with constraints T/W < 1 and has to be a slow and controlled flight

Procedure :

Step – 0 : We fix our TWR to be 0.8 here

Step – 1 : We calculate the ready-to-fly weight (design + electronics). It comes out to be 450.13 g. The 'model weight' is 93.63 g (say, we chose some plan and got this value)

Assumed Components list :

Component	Weight
Airplane model	250 g
Brushless motor 1000kV	50 g
Propeller	5g
ESC	26 g
Receiver	14.9 g
Servo (x 4)	24 g
Control rods	12 g
Landing gears/ wheels	9.6 g
Battery	215 g
Total	606.5 g

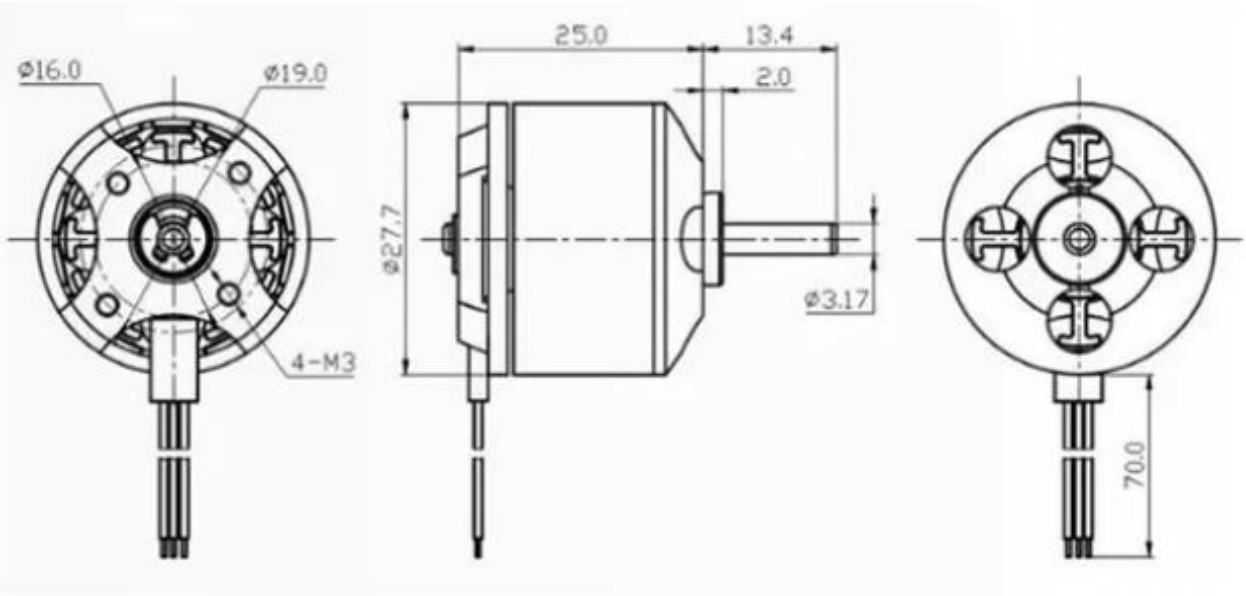
Step – 2 :

$$Thrust = 0.8 * 606.5 = 485.2\ g$$

Step – 3 : Now, since we need slow flying, we consider a lower kV motor. For this example, we choose 1000kV motor

Model of motor : A2212 1000kV BLDC Brushless DC Motor

(We look for the thrust/pull value)



MODEL	KV (rpm/V)	Voltage (V)	Prop	Load Current (A)	Pull (g)	Power (W)	Efficiency (g/W)	Lipo Cell	Weight (g) Approx
A2212	930	11.1	1060	9.8	660	109	6.1	2-4S	52
	1000		1047	15.6	885	173	5.1		
	1400		9050	19.0	910	210	4.3		
	1800		8060	20.8	805	231	3.5		
	2200		6030	21.5	732	239	3.1	2-3S	
	2450		6x3	25.2	815	280	2.9		

- The above image is from botshop website (*Just get the data from somewhere !!*)
- The maximum pull, the motor can offer is 885 g but we are in need of only 485.2 g . So this is a good choice for us. Also we can see the recommended propeller is 1047 (diameter : 10 in & pitch : 4.7 in)

Datasheet of the model :

A2212/13T TECHNICAL DATA

No. of Cells:	2 - 3 Li-Poly 6 - 10 NiCd/NiMH
Kv:	1000 RPM/V
Max Efficiency:	80%
Max Efficiency Current:	4 - 10A (>75%)
No Load Current:	0.5A @10V
Resistance:	0.090 ohms
Max Current:	13A for 60S
Max Watts:	150W
Weight:	52.7 g / 1.86 oz
Size:	28 mm dia x 28 mm bell length

Shaft Diameter:	3.2 mm
Poles:	14
Model Weight:	300 - 800g / 10.5 - 28.2 oz

An small yet powerful motor for planes up to 800 grams (28 oz) using 3 li-poly cells. We suggest propping for around 140 watts continuous power with short bursts up to 180 watts. An excellent higher-powered replacement for geared Speed 400-480 motors in slow-flying or 3D planes that require a larger 10" propeller. Use on sailplanes up to 28 oz, trainers up to 25 oz, aerobatic aircraft up to 18 oz and 3D airplanes up to 15 oz. Recommended prop is 10 x 5 on 3 li-poly cells.

The motor features a 3.2mm hardened steel shaft, dual ball bearings, and has 3.5mm gold spring male connectors already attached and includes 3 female connectors for your speed control. Now includes collet type prop adapter and radial motor mount. Mounting holes have 16mm and 19mm spacing on centers and are tapped for 3mm (M3) screws.

Similar to Welgard A2212-13, AXI Gold A2212/26, Welgard C2830-12, E-Flite Park 400. Great replacement motor for a 1/2A Texaco engine.

Important Information has been highlighted. Keep a note of the current, voltage and power values since it will come handy for future component calculations. *Here also, we can see that, in the datasheet as well, they recommend 10x5 prop i.e. Dia 10in & pitch 5in*

Propeller	Gear Ratio	Volts	Amps	Watts	RPM	S
GWS HD 8x4	1	7	3.35	23	6630	2
GWS HD 8x4	1	7.9	4.1	32	7410	2
GWS HD 8x4	1	8.9	4.85	43	8220	3
GWS HD 8x4	1	9.9	5.65	55	8940	3
GWS HD 8x4	1	10.9	6.5	70	9660	3
GWS HD 9x5	1	6.9	5.5	37	6000	2
GWS HD 9x5	1	7.9	6.7	52	6660	3
GWS HD 9x5	1	8.9	7.85	69	7290	3
GWS HD 9x5	1	9.9	9.25	91	7920	3
APC E 10x5	1	6.9	7	48	5610	2
APC E 10x5	1	7.9	8.45	66	6120	2
APC E 10x5	1	8.9	9.9	88	6690	3
APC E 10x5	1	9.9	11.45	113	7170	3
APC E 10x5	1	10.9	13	141	7650	3
GWS HD 10x6	1	6.9	7.2	49	5610	3
GWS HD 10x6	1	7.9	8.7	68	6180	3
GWS HD 10x6	1	8.9	10.1	89	6690	3
GWS HD 10x6	1	9.9	11.7	115	7200	4
GWS HD 10x6	1	10.9	13.25	144	7680	4
GWS HD 10x8	1	10.8	18.2	196	6390	4

3S battery implies 11.1 V. The closest is 10.9 V in datasheet. We note down the current, voltage and power values.