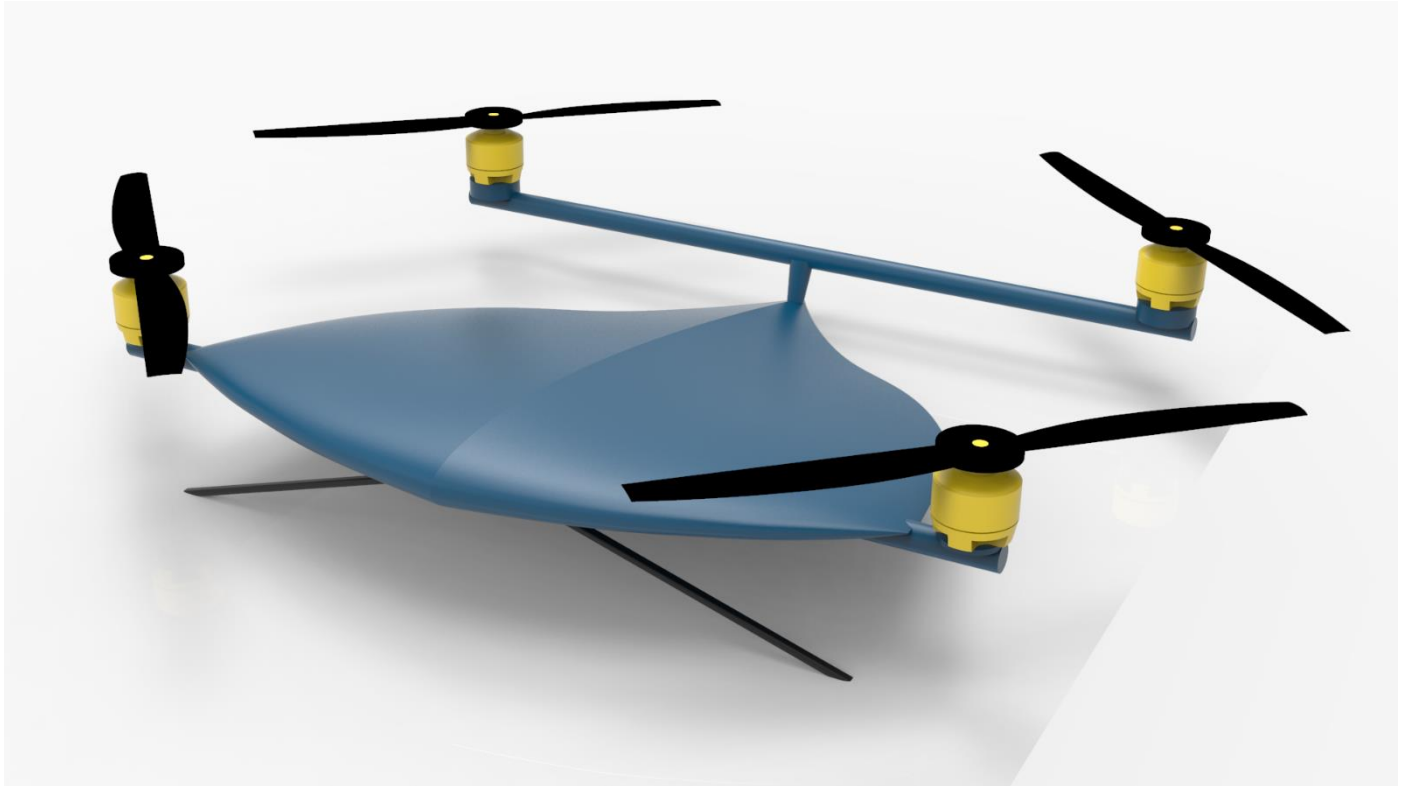
Aero-copter
Quadcopter Design

Ramesh M

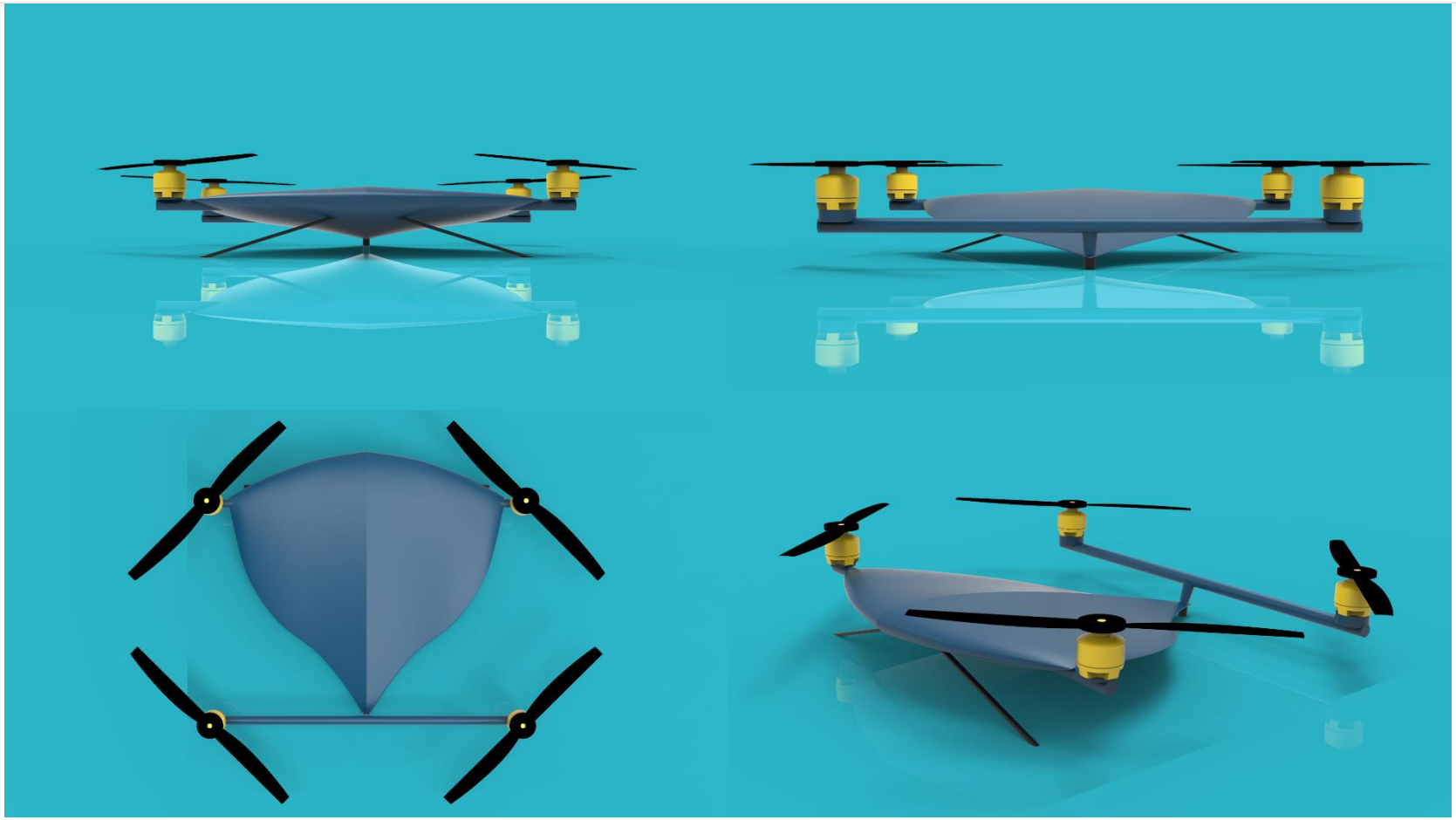


KALAM 2020

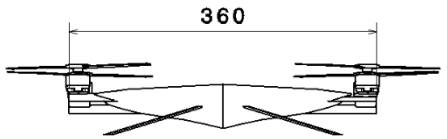
Aim

- To build a compact UAV (relatively) for the payload of 4 Kg.
- To make use of airfoil design to gain altitude.

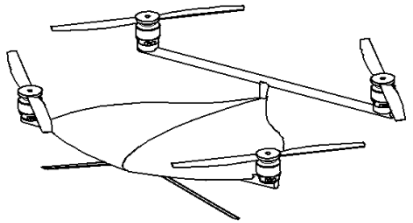
Multi view



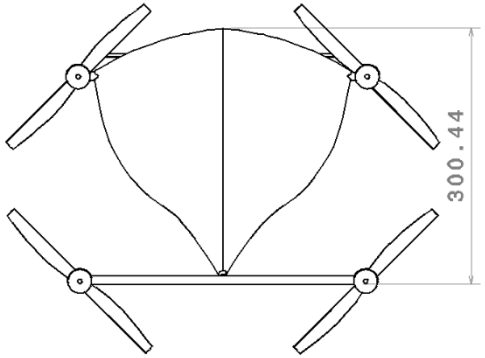
Draft of the design



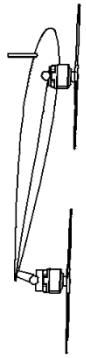
Front view



Isometric view



Top view



Left view

Falcon - KALAM 2020
Scale: 1:5
All the units are in mm

Component selection

Components	Parameter
Motor	700 Kv
Propeller	9x9
ESC	50 A
Battery	8000 mAh

Weight estimation

Components	Nos	Weight (Kg)
700 kV BLDC Motor	4	0.864
9x9 inch Propeller	4	0.096
50 A ESC	4	0.224
Battery	1	0.607
Frame	1	0.550
Total		2.2

Thrust calculation

- All up mass – 4 Kg
- T/W = 1.8
- Thrust from 1 Propeller = 1.5 Kg
- Total thrust = 7.2 Kg

Prop Manf.	Prop Size	Input Voltage	Motor Amps	Watts Input	Prop RPM	Pitch Speed	Thrust Grams	Thrust Ounces	Thrust Eff. Grams/W
APC	9x6-E	18.5	17.04	315.1	11,268	64.0	1380	48.68	4.38
APC	9x7.5-E	18.5	26.41	488.7	10,597	75.3	1484	52.35	3.04
APC	9x9-E	18.5	29.51	546.0	10,401	88.6	1504	53.05	2.75
APC	10x6-E	18.5	22.84	422.5	10,839	61.6	1823	64.30	4.31
APC	10x7-E	18.5	27.06	500.5	10,552	69.9	1916	67.58	3.83
APC	10x10-E	18.5	38.66	715.3	9,835	93.1	1708	60.25	2.39
APC	11x5.5-E	18.5	28.86	533.8	10,379	54.1	2423	85.47	4.54
APC	11x7-E	18.5	34.27	633.9	10,092	66.9	2558	90.23	4.04
APC	11x8-E	18.5	37.54	694.5	9,909	75.1	2389	84.27	3.44
APC	11x8.5-E	18.5	40.54	750.0	9,735	78.4	2446	86.28	3.26
APC	11x10-E	18.5	45.73	845.9	9,410	89.1	2213	78.06	2.62
APC	12x6-E	18.5	38.56	713.4	9,837	55.9	3048	107.51	4.27
APC	12x8-E	18.5	45.21	836.4	9,356	70.9	2612	92.13	3.12
APC	13x4-E	18.5	32.65	604.1	10,201	38.6	3062.6	108.03	5.07
APC	13x6.5-E	18.5	50.68	937.6	9,038	55.6	3482	122.82	3.71
MAS	8x6x3	18.5	14.58	269.7	11,472	65.2	1238	43.67	4.59
MAS	9x7x3	18.5	23.11	427.6	10,836	71.8	1858	65.54	4.35
MAS	10x5x3	18.5	20.46	378.5	10,960	51.9	1863	65.71	4.92
MAS	10x7x3	18.5	29.35	542.9	10,346	68.6	2338	82.47	4.31
MAS	11x7x3	18.5	35.51	656.8	10,006	66.3	2749	96.97	4.19
MAS	11x8x3	18.5	38.53	712.8	9,833	74.5	2815	99.30	3.95
MAS	12x6x3	18.5	39.26	726.3	9,735	55.3	3109	109.67	4.28
MAS	12x8x3	18.5	52.80	976.7	8,903	67.4	3692	130.23	3.78

Flight time

$$Flight\ time = \frac{Battery\ capacity}{Current\ drawn\ (total)}$$

$$Flight\ time = \frac{8000}{36.5}$$

$$Minimum\ Flight\ time = 3.28\ minutes$$

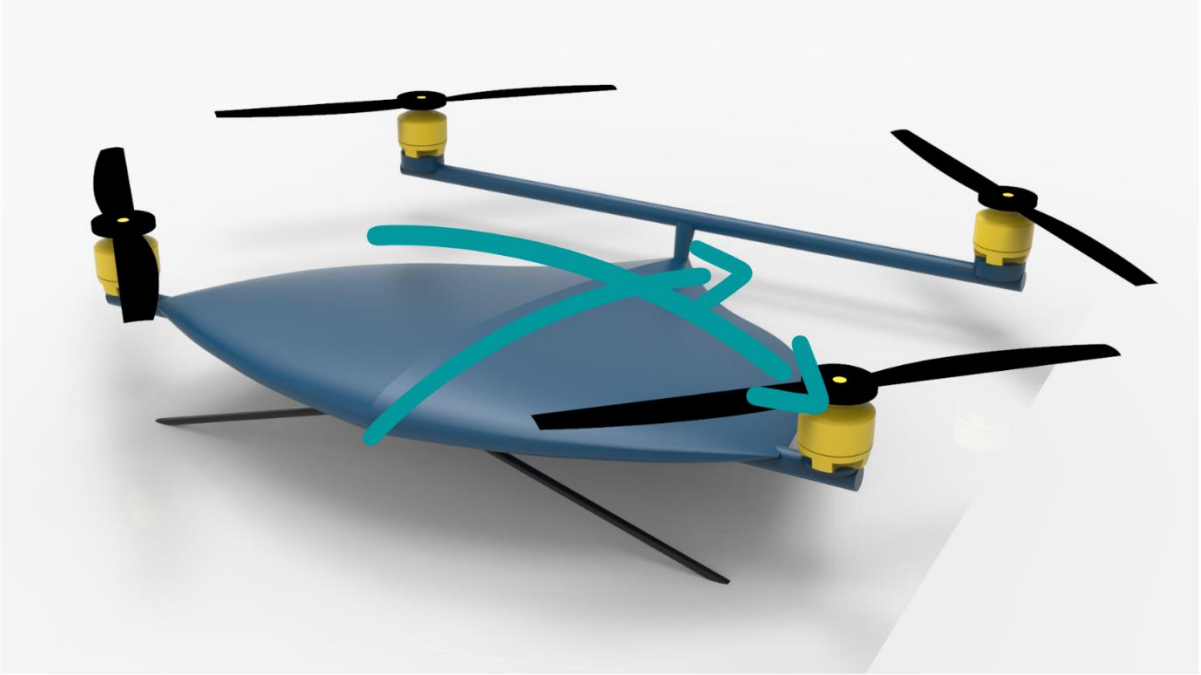
Speed calculations

- Maximum forward speed = 24.2270 m/s.
- Rate of climb = 14.4 m/s.
- The values mentioned here are at maximum conditions i.e. the throttle at 100%.

- Values validated at https://drocula2.herokuapp.com/ (Website developed by at VIT Vellore)

Design features

- Hyperbolic paraboloid – Curves in both the access (Structural naturally strong)
- The natively tilted airfoil will have a positive AOA when pitched up, which is used for the gaining of Altitude while pitching up.



Thank you!