

Tilt Rotor



Team : Osprey

Members:

1. Manjeet Godara
2. Shubham Dhake
3. Nishant Prakash

Problem Statement

Tilt Rotor

It is a vertical takeoff and vertical landing capable aircraft(VTOL) with two flight modes:

1. For takeoff, landing or hovering its motors provide downward thrust, carefully balancing the aircraft by adjusting the RPM and tilt of motors, which is all done by a flight controller board.
2. For level flight its motors lift by 90 degree providing forward thrust just like conventional aircrafts, where wing provide the lift.

There is a third transition mode, as the name says it is the time when motors make transition from VTOL mode to forward flight, this mode is also carefully controlled by the flight controller board and the flyer so aircraft doesn't lose altitude or stability during transition.

Problems we might face:

1. Weight of aircraft.
2. Balancing Centre of mass of aircraft to right place..
3. During hover thrust of motors might get reduced as some part of airflow is blocked by the wing, since we only want the motors to rotate not the whole wing.

We want to make this project under technovation because we want to build a stable, good looking and light aircraft, so it will have a higher budget and might take longer to make a stable aircraft than the span of ITSP.

Also it is a little more complicated project as it contains twin rotor aircraft+twincopter.

Our Plan

Our basic design consists of two main brushless motor for lifting & propulsion which will be attached to a 90 degree rotatable plate on which motor will be mounted which is hinged to wing so load of the motor and thrust will be borne by the hinge and a high torque servo will rotate the motor plate about the hinge.

For stabilization we are using Hobbyking KK2.1.5 Board, it has a open source firmware: OpenAero2 VTOL for our application and it also has a LCD display which is very useful as we don't have to connect it to computer for every small adjustment.

A twin rotor aircraft has stability issues as the aircraft may pendulate, so we might add a small low power motor to rear of the plane which will aid in stabilizing the aircraft.

As there might be a motor in the rear part we are considering a twin boom tail section.

We can either stop the rear motor in forward flight mode or make it tilt too, in this case we can also use thrust vectoring of the rear motor to aid pitching the aircraft.

To address possible problems we are:

1. Using combined construction materials like Carbon fiber, balsa wood, high density thermocol and aircraft grade plywood to address issue of weight, we'll also do structural analysis of aircraft so it is light and have proper safety factor too. We expect the aircraft to weigh about 1kg.
2. This can be corrected by calculating where COG should be placed, and having enough room for battery to move around and to make fine adjustment to COG, which can only be done by test flying the aircraft and observing its behaviour.
3. We can either make the rotating mechanism and motor a little away from the wing or have a part of the wing rotate with the motor so the prop wash is always parallel to wing chord.

We also intend to use retractable landing wheels so the end product looks better in flight.

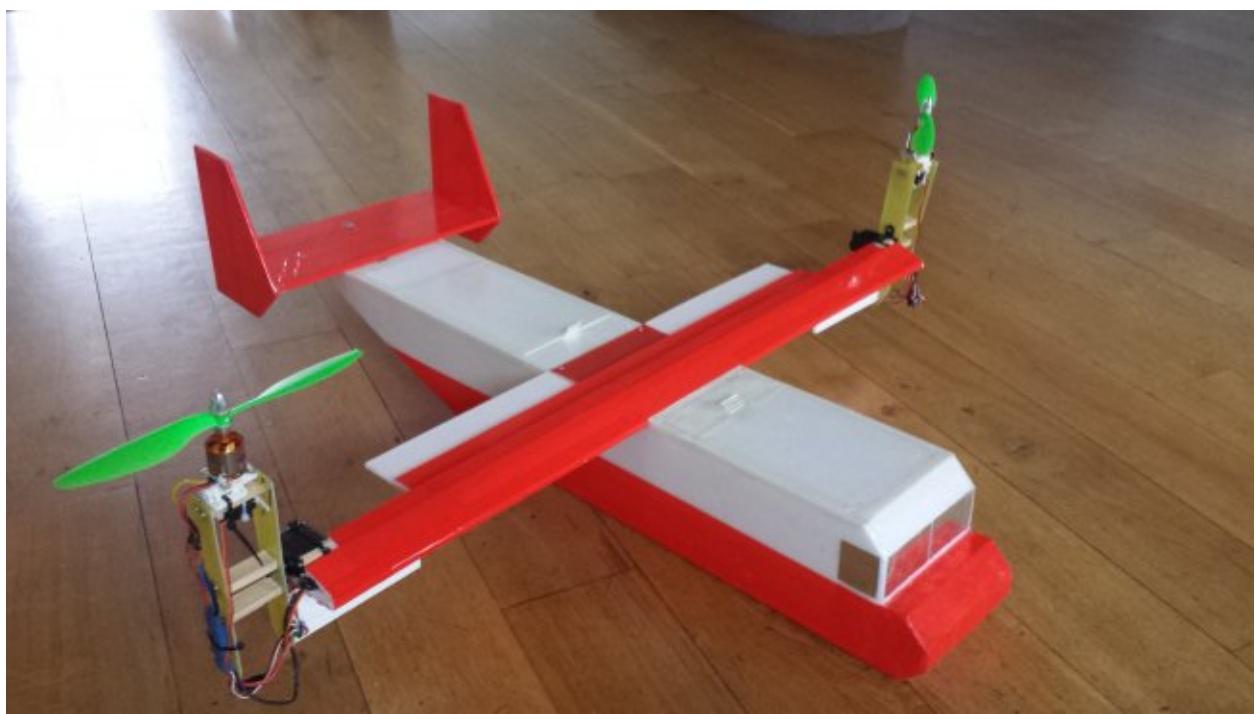
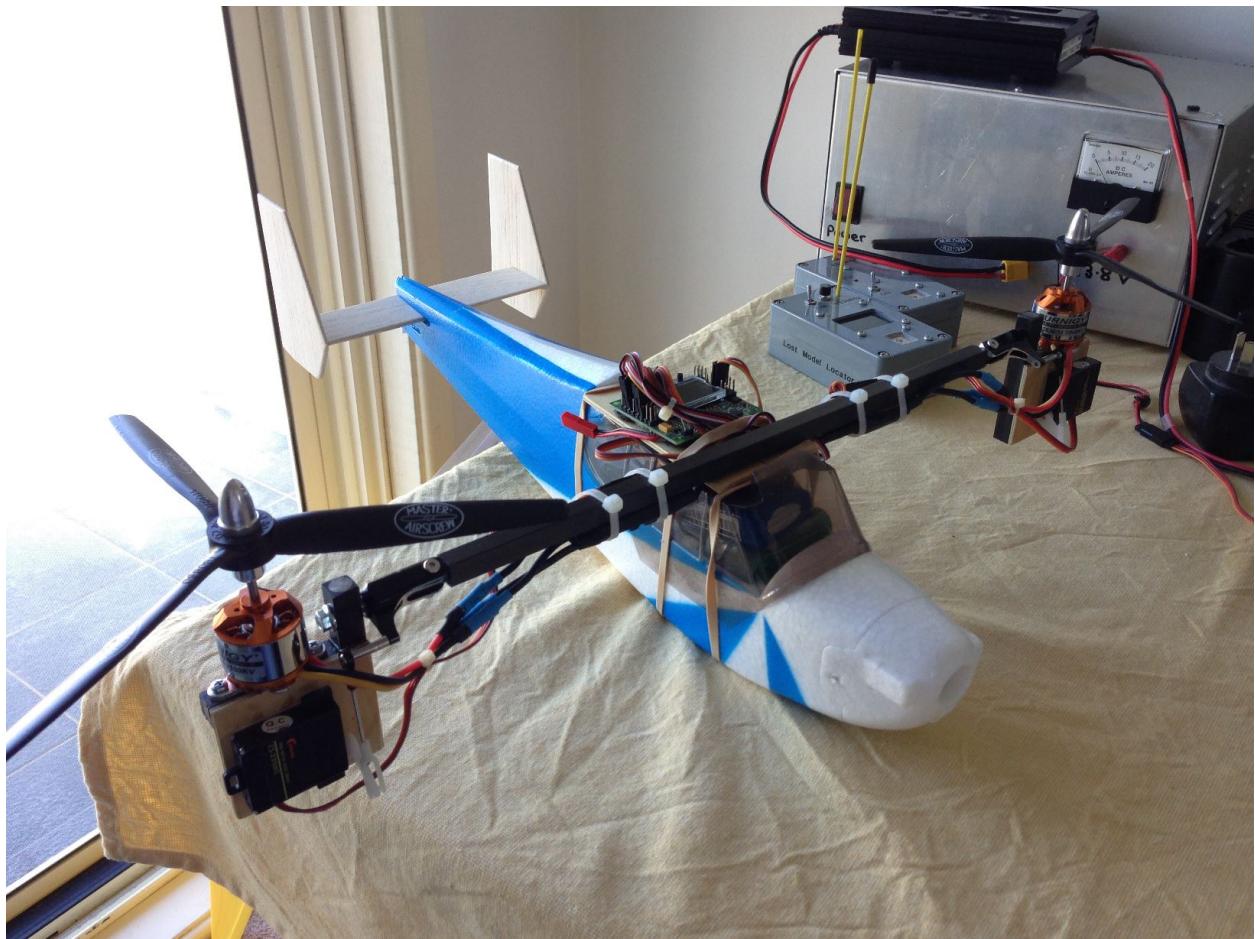
Expected Weight : 1Kg

Wingspan: 1m

Cost Estimate

Name	Quantity	Price	60Rs/\$
Motor	2	30	3600
ESC	2	19.74	2368.8
Battery	1	26.87	1612.2
Motor tail	1	15	900
ESC tail	1	12.5	750
Servos	2	20	2400
Servo control surface	4	5	1200
KK 2.1.5	1	30	1800
Wire and connectors	1	25	1500
Landing gear	1	30	1800
Propellers	1	25	1500
Balsa	2	250	500
Carbon rods	4	350	1400
Foams	2	250	500
covering film	3	250	750
construction materials	1	2000	2000
			0
			0
customs	1	3000	3000
Shipping		45	2700
Shipping		500	500
		total	30781

We have to select particular components but these are the max expected cost of components, we are bit uncertain on customs so they may vary.





Timeline

Place the order on hobbyking

Till 5 May - Design the whole tiltrotor properly to each detail because design and looks are also of high importance

Till 11 May (1 week)-

1. Check mechanism for rotating motor using a flight controller board
2. Cut out wing from foam
3. Make centre fuselage

Till 18 May (1 week) -

1. Install motor rotating mechanism on wing
2. Make tail part(includes tail and tail motor)
3. Attach centre fuselage and tail part to wing.

Till 25 May (1 week)

Finishing and Improving

Till 25th May 1st prototype will be ready.

After that we will be working on next prototype in which we will tackle problems faced by us in 1st prototype.