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# Design and Analysisof India`S first tilt Rotor (V-44) Aircraft

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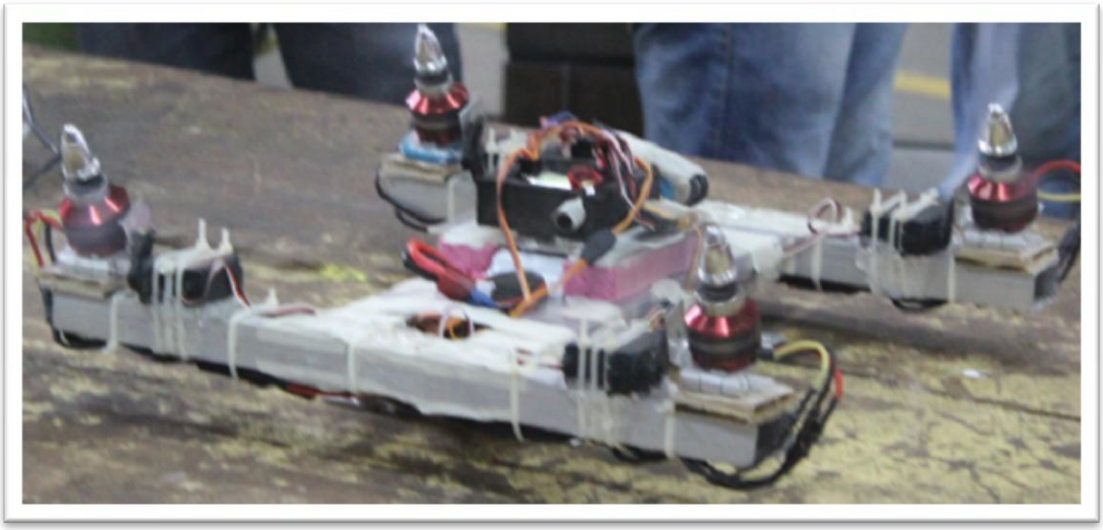
***Abstract:*** *A Tiltrotor is an aircraft which has a capability of vertical takeoff landing (like in helicopters) and fixed wing aircraft. The great advantages of this aircraft are high maneuverability, energy efficient, high operational speed. It has both the advantages of a fixed wing and a rotary wing aircraft. A Tilt rotor aircraft consist of coaxial rotatory wing which are controlled by a heavy duty servo motor in the central part of fuselage where all other electronics part are fabricated inside it.So in this paper we represent the first tilt rotor aircraft, so that it can use for the sake of military, and for UAV purposes, like recently in Chennai's flood it can be helpful for victims in many ways.And in the future the major application of this tilt rotor can be for the transportation includes transportation of heavy military vehicles and weapons from one place to another where other transport vehicles can't reach easily especially in mountainous region and shipboard operations of India.*

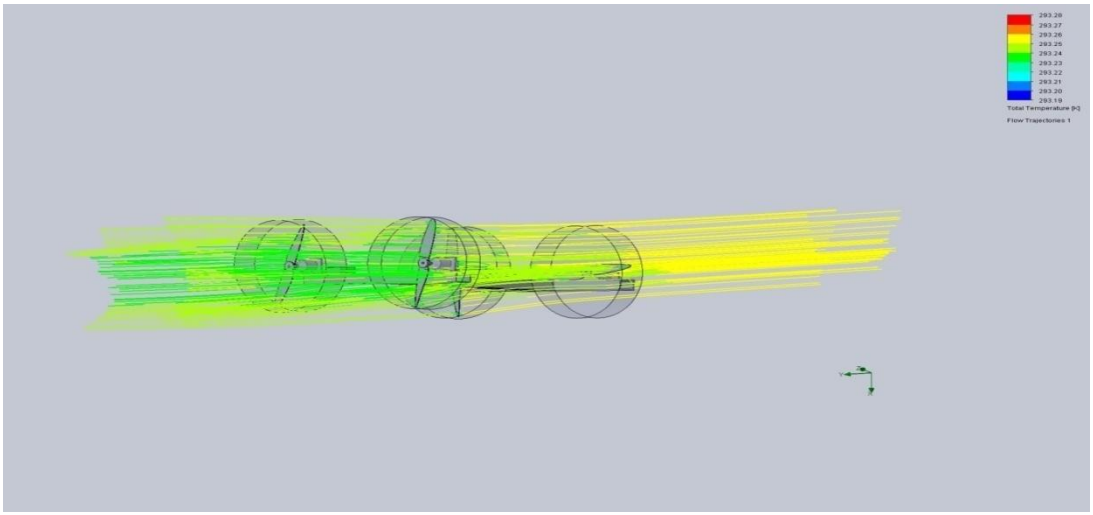
## I. Introduction

One of the most important problems of Indian armed forces are the transportation of military troops vehicles and weapons at the battlefront especially in those areas where normal aircraft does not get easily reached like mountainous region of the Himalayas and in the shipboard operation so the solution of the above problem is tiltrotor aircraft which have capability of both fixed wing and rotatory wing. Also the traditionally wing aircraft require large airstrips whereas on the other side a rotatory wing aircrafts have less speed and efficiency so that the problem is solved by the combination of both fixed wing and rotatory wing. Further this can be used as a full-fledged UAV to perform rescue operation and become helpful in terrorist active areas from where it give the live aerial footage to the headquarters. So in this paper a detailed design and analysis of RC tilt rotor aircraft is given which is fabricated by us.



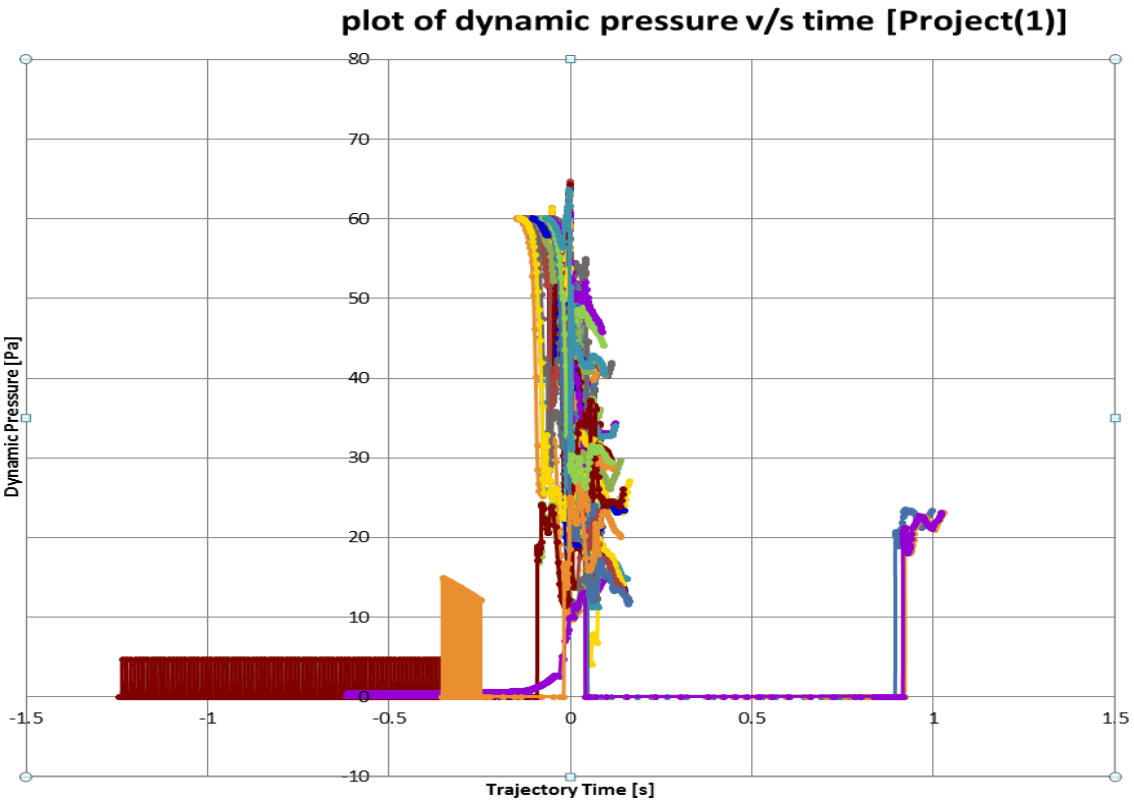
## II. Analysis Of Tiltortor

The flow simulation analyses of tilt rotor were done in the solid works 2013 by giving the various boundary conditions setting the computational domain and by inserting various global goals according to analysis we done. Here the analysis report shows the ratio of total temperature and flow trajectories of tilt rotor in airplane mode.



**MIN/ MAX TABLE:-**

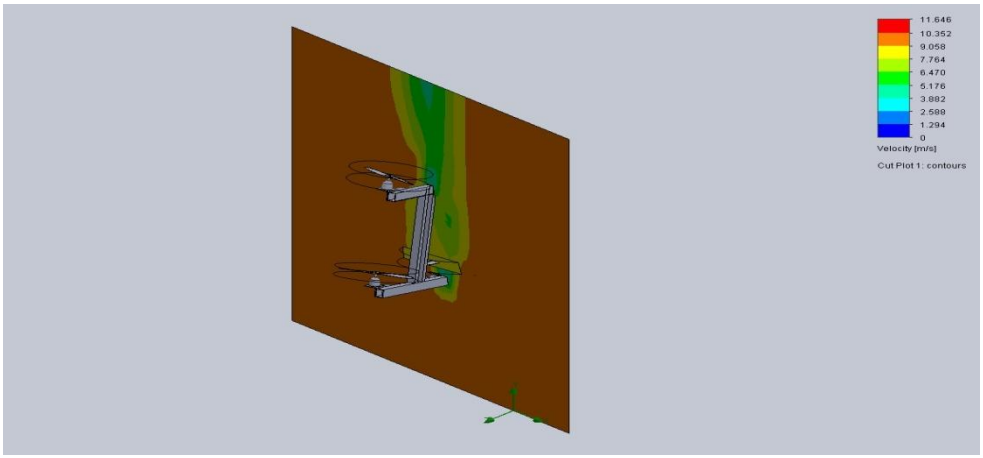
| NAME | MINIMUM | MAXIMUM |
|---|---|---|
| PRESSSURE (Pa) | **97680.5** | **105043.59** |
| TEMPERATURE(K) | **281.39** | **313.65** |
| DENSITY(kg/m$^3$) | **1.16** | **1.25** |
| MASS FRACTION OF AIR[ ] | **0.9928** | **0.9928** |




## III. Tilting Mechanism Construction

In this project the bars of aluminum are used for the construction of tilt rotor due to its light weight, high strength, easily machining and corrosion resistance. The tilt rotor mechanism consist of a pair of L joint connected in such a way which provide a rotational motion from (0 to 90degree) in forward direction, on which the motor mounted and the rotatory motion is transmitted by a means of high torque digital Servo motor rested on the bars of the aluminum at the end of the wings. This configuration remains same at all other 3 end.

(V 44) During Take Off




The above figure shows the cut plot area of velocity of (V44) aircraft.

**TOTAL AIRCRAFT WEIGHT ESTIMATION:-**

| S.NO | PARTS NAME | WEIGHT IN (GMS) |
|---|---|---|
| 1 | CHASSIS | 100 |
| 2 | BLDC MOTOR | 80*4=320 |
| 3 | ESC | 30*4=120 |
| 4 | HINGE JOINT | 20*4=80 |
| 5 | PROPELLOR | 50 |
| 6 | SERVOS MOTOR | 50*4=200 |
| 7 | BATTERY | 450 |
| 8 | OTHERS | 50 |
| 9 | PAYLOAD WEIGHT | 1000 |
| | | TOTAL=2370gms |

Hence total takeoff weight W=2.370kg (approx.)
Coefficient of lift ($C_l$) = lift/ ($1/2\rho v^2 s$) = 2.370/ (.5*1.225*10*10*.02) =1.93
Therefore $C_l$=1.93
Where ρ=Density of air=1.225kg/m^3
V= velocity =10m/sec
S= surface area=.02m^2

## IV. Conclusion

After completing the research work on it we came to the conclusion that the proposed aircraft is feasible for flying and has many military and civilian applications. Further it can be made into full-fledged major(UAV) by installing the FPV and GPS tracking system so that it can be used for both military and rescue operations. Also it can be used for aerial photography and for variouscommercial purposes.

(V 44) In Flight Mode

## References

[1] Computational Fluid Dynamic", by Solid works 2013.
[2] Coefficient of lift "$C_L$ Cal" https://www.grc.nasa.gov/www/k-12/airplane/liftco.html