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Overview of Unmanned Cargo Aircraft.

Rohan Anabhavane[1], Sharvari Ghadi[2], Nikhil Ghawale[3], Vaibhav Gurav[4]

Department of Mechanical Engineering, MUMBAI University, Mumbai-400305
rohananabhavane@gmail.com
Department of Mechanical Engineering, MUMBAI University, Mumbai-400305
sharvarighadi1998@gmail.com
Department of Mechanical Engineering, MUMBAI University, Mumbai-400305
nikhilghawale153@gmail.com
Department of Mechanical Engineering, MUMBAI University, Mumbai-400305
guravvaibhav5996@gmail.com

Abstract—*Theaircraft first invented by wright brothers. Previous 10 years, number of passengers death per kilometer increases. to overcome these problems, new innovation done by scientist which was unmanned aerial vehicle (UAV).UAV used in many sectors such as military, surveillance of geographical boundary ,agricultural ,transportation. In India UAV refused in public sector, but most probably used in military because there is no human interference. So there is no risk to soldier life. In India there is lack of awareness about UAV, sometime the work which not possible with human interference model which did with the model without interference.*

Keywords— ***Aircraft, UAV, Unmanned Vehicle, cargo aircraft, RC plane.***

I. INTRODUCTION

The objective of this study is designed compress aircraft and lift the maximum payload with utilizing minimum power within given take off & landing distance. As many conventional UAVs are working on maximum power. So we will increase the efficiency of aircraft, speed of aircraft, and performance of aircraft by using minimum power.

II. CONSTRAINTS AND REQUIREMENTS

As per the demand & requirements everyone wants effective and faster RC plane, while hunting the requirement we found that electric motor or engine can be used. Here main task is selection of motor to satisfying our requirements. For power source battery is required, so we selected cell battery was one of our first constrained.

Here we focused on the geometrical appearance of RC plane, and not manufactured the huge plane because of capability of selected motor. Every time trial and error method cannot be used because every part is costly so before we must have proper justification.

Then we moved towards the selection of suitable airfoil which is essential for plane. Here performance and efficiency of RC plane, depend upon the selection of motor and airfoil. We know the RC plane lifted Avg. of 8- 13 Kg in India. So we decided to lift the payload as 10 Kg as per the theoretical calculation. Here, second main constraintis balancing the RC plane**without gyroscope**.

Conventional RC plane carries the same payload but invention purpose we reduce the power upto 1000 watt. Here becomes the big challenge for us that to lift maximum payload maximum power is used but in our aircraft more payload is lifted by less power.

III. PROPOSED METHODOLOGY

Design plays important role in project. In design, we used the solidworks, Ansys& XFLR softwares for primary calculations and analysis. As per the theoretical calculations and assumptions, we focused on the CAD model and XFLR's solution. If theoretical value and software solution approximately equal to each other then we goes in a right way. After this, we goes for analysis of each part. If design is safe then we follow the next step which is manufacturing. If design is not safe then we go to second iteration till the design is safe. Here we successfully ended with design phase.

Initially, we defined the overall weight of plane including weight of electronics, payload and pylon respectively. Accordingly we framed our wing's parameters such as wing loading, wing area, aspect ratio etc.

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i. Airfoil Design:

We analyzed foils CH10 and S1223 and we found that foil CH10 gives high Cl /Cd ratio, less Cd and low Clvs ά ratio and S1223 give high Clvs ά value and low Cl /Cd ratio comparatively. Since we were hunting for a foil with high Cl/Cd and a high Clvs ά value, we had to interpolate both the airfoils and develop a new foil named ARSYA. Inferring Reynold's Number as 4, 50,000 an analysis was performed on the foil to extract various data.

TABLE 1
AIRFOIL PROPERTIES COMPARISON

Foil	Cl at 0˚	Cl /Cd at 5˚	Cm vs ά
ARSYA	1.37	54	-0.19
S1223	1.3	71	-0.24
Ch10	1.2	86	-0.15

ii. Wing design:

According to weight and all loads on fuselage and wing, we determined external loads to be applied on wing to stimulate the actual load, which acts on wing and determined the maximum deflection.

TABLE 2
COMPARISON OF SHAPE OF WING

Parameter	Weighting	Rectangular	Elliptical	Tapered
Construction	40%	**5**	2	3
Flight Performance	30%	**3**	3.5	3
Theoretical Analysis	30%	**3**	2	2
Total	100%	**3.8**	2.45	2.7

iii. Drag Analysis:

The 3D drag polar on an airplane is given by (from Nicolai's White paper)

$$Cd = Cdmin + K'Cl2 + K''\ (Cl - Clmin)2$$

Cdmin is found by summing the contribution of each component, as calculated with equation:

$$Cdmin = \frac{FFCfSwetted}{S}$$

The 3D drag polar contribution of each aircraft of the overallC_{dmin},

TABLE 3
PARAMETERS OF PLANE

Part	Planform	Wetted area	Reference length
Wing	1.17	2.45	2.6
Fuselage	0.19	0.76	1.856
Elevator	0.25	0.51	1
Rudder	0.11	0.19	0.5

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Then heinviscid induced drag factor K is calculated for equation, $K' = \frac{1}{\pi ARe}$

NowC_{lmin} is determine as a point of lowest $C_d$from the drag polarThen the viscous that drag factor K'' is determine as the slop of thenearly linear relation, shown. NowClminis compared at relevant Reynoldnumber for the wing and K"is found. Then this value can be substituted back into equation and airplanes 3D drag lift coefficient for all airfoil.

$$Cd = 0.03 + 0.063 * cl^2 + 0.022 * (cl - 0.44)^2$$

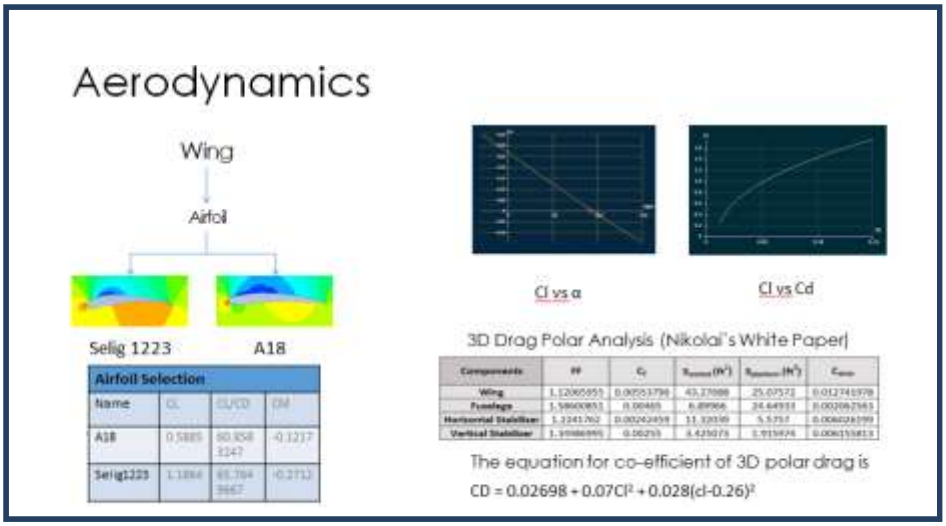

FIGURE 1:DESIGN AND ANALYSIS

IV. CONTROL SYSTEM:

The transmitter and receiver used in aircraft is JRXG7 (DMSS 2.4GHz).In order to ensurethat the servo used to control the aircraft are of adequate size, the following calculation was performed.

$$T = 8.5E - 6 * \left[C^2 V^2 L \left(\frac{\sin s1 \tan s1}{\tan s2} \right) \right]$$

For the calculation, the airspeed was assume to be the top speed of the aircraft (17 m/s). A conservative assumption that the servo deflection is no more than the 45º, it was determined that the maximum torque required for each aileron would be 34.58 oz-in ,which makes Avionic AV55DMG servo which can provided torque of 138.87 oz-in most eligible for serving the purpose.Also the torque required for elevator and rudder werecalculated to be 39.22 oz-in. Hence Avionic AV55DMG servo is used for the purpose.

V. CONCLUSION

We conclude that the aircraft fly with maximum payload within given constraints. Fabricated model help us to explore application of UAV in various sector. During this project, we enhanced our skill like using different type of tools & software. It will help us to explore various specialization fields like structural Analysis, Computational Fluid Dynamics, and Wood Working etc.

It will not only give students a hand-on experience with hand tools as well as advanced software's but also give them an opportunity to interact with industrial tycoons in the field testing.

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