

Design, Fabrication & Analysis of a High Winger Conventional Tail Radio Controlled Airplane

Pradyumna S V ^[1], Prateek R ^[2], Raju B S ^[3]

[1],[2] Students of B.E in Mechanical Engineering, Reva ITM/Reva University, Rukmini Knowledge Park, Yelahanka, Bengaluru-560064,Karnataka,India.

[3] Associate Professor,Department of Mechanical Engineering, Reva ITM/Reva University, Rukmini Knowledge Park,Yelahanka,Bengaluru-560064,Karnataka,India.

E-mail-prateekcpc@gmail.com

Abstract-The ever fast growing information technology is enabling a re-definition of the early stages of aircraft design which has been restricted to mostly statistical and empirical approaches because of lengthy and costly simulation times .The paper basically deals with designing a radio controlled aircraft by considering various parameters such as aspect ratio, taper ratio, power loading etc according to the requirements. It also deals with the type of wing and airfoil to choose from a vast variety of airfoils. During design, electronic components are to be considered and number of channels to be used is taken into account. Based on the above parameters a 3-D cad model of our aircraft is designed, using Solid Edge V19 Software. After designing the aircraft fabrication is one of the important factors to be considered. Fabrication mainly depends on the type of material employed in manufacturing the aircraft by considering the availability, cost, durability, strength and how easily it can be mould into required shape. Fabrication process also involves the various techniques that were adopted in order to manufacture the aircraft. In basic analysis, the main focus is on how various parameters such as lift, drag, co-efficient of lift v/s angle of attack etc behave on the wing. Using 3-D cad model of the aircraft simulation is done and corrected for errors if any. Finally our own prototype manufactured is displayed & tested practically.

Keywords-Radio controlled aircraft, Aspect ratio, Airfoil, Lift, Drag, Angle of attack, Taper ratio, Power loading, Wing, Tail, Fuselage etc

INTRODUCTION

A radio-controlled (model) aircraft (often called RC aircraft or RC plane) is a small flying machine that is controlled remotely by an operator on the ground using a hand-held radio transmitter. The transmitter communicates with a receiver within the craft that sends signals to servo mechanisms (servos) which move the control surfaces based on the position of joysticks on the transmitter. The control surfaces, in turn, affect the orientation of the plane.

Flying RC aircraft as a hobby has been growing worldwide with the advent of more efficient motors (either electric and miniature internal combustion or jet engines), lighter and more powerful batteries and less expensive radio systems. A wide variety of models and styles are available.

Scientific, government and military organizations are also utilizing RC aircraft for experiments, gathering weather readings, aerodynamic modeling and testing, and even using them as drones or spy planes.

AIM

- 1) Building a stable aircraft.
- 2) It must have good maneuverability
- 3) Most likely to be a monoplane
- 4) It should have 4channels
- 5) The aircraft must have a classic look and it should have good strength
- 6) A streamlined body with landing gears

BASIC DESIGN CONCEPT

Utilizing the idea of a classic airplane along with the above requirements, referring to many classic monoplanes such as cessna skylane, piper cub, Fokker trimoter airliner etc an empirical formula in calculating various dimensions for our own aircraft was derived and computed.

DESIGN METHODOLOGY

The design methodology basically has 3 phases:

Preliminary design:

Aircraft design can be broken into 3 major phases, as depicted in the figure 1- It is in conceptual design that the basic question of configuration arrangement, size and weight, and performance are answered.

The first question is, “can an affordable aircraft be built that meets the requirements?” if not some amount of tradeoff must be made to the requirements.

Design is a very fluent process. New design and problems emerge as a design is investigated in ever increasing detail. Each time the latest design is analyzed and sized, it must be redrawn to reflect the new gross weight, wing size, engine size, wing configuration and other changes. Early wind tunnel tests often reveal problems requiring some changes in the configuration. So the basic questions that have to be answered are:

- 1) Will it work?
- 2) What does it look like?
- 3) What requirements drive the design?
- 4) What tradeoffs should be considered?
- 5) What should it weigh and cost?

Project design:

Project design can be set to begin, when the major changes are over. The big questions such as whether to use a canard or an aft tail have been resolved. The configuration arrangement can be expected to remain about as shown on current drawings, although minor revisions may occur at some point late in project design, even minor changes are stopped when a decision is made to freeze the configuration. During preliminary design the area such as structures, landing gears and control systems are to be designed and analyzed at various portions of the aircrafts. Shown in figure 1.

The ultimate objective during project design is to start up the detailed design stage also called “full scale development”. So the things that need to be done in this process are:

- 1) Freeze the configuration
- 2) Develop the actual cost estimate
- 3) Design major items

Detailed design:

Assuming a favourable decision for entering full scale development, the detailed design phase begins in which the actual pieces to be fabricated are designed. The design process adopted is as shown in fig 1. For example during project design; the wing box will be designed and analyzed as a whole. During detail design, that whole part will be broken down into individual parameters such as chord, aspect ratio, taper ratio etc.

Another important part of detailed design is called “**production design**”. In detail design each and every part of the aircraft is designed separately in detail. The thing that has to be considered in this process are:

- 1) Design the actual piece to be built.
- 2) Design the tooling and fabrication process.
- 3) Test the major items such as structure, landing gears.
- 4) Finalize the weight and performance estimates.

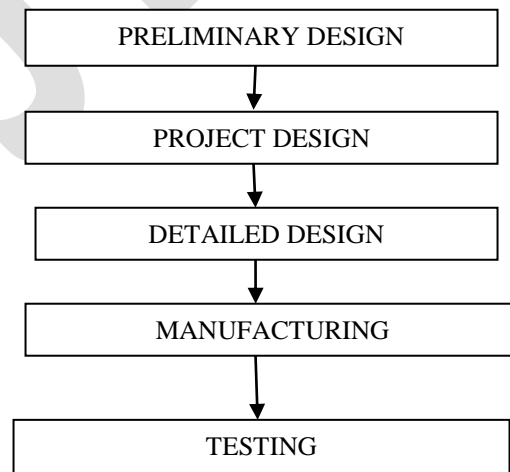


Fig 1: Design flow process chart.

PARAMETERS TO BE CONSIDERED WHILE DESIGNING AN AIRCRAFT

In order to consider different parameters the aircraft must be split into various categories of components, such as:

1) Wing design:

Eighteen parameters must be determined in wing design, they are as follows:

- 1) Number of wings: It is basically the number of wings to be used in the aircraft. Ex: monoplane, biplane, tri-plane.
- 2) Vertical position relative to the fuselage (high, mid, or low wing): One of the wing parameters that could be determined at the early stages of wing design process is the wing vertical location relative to the fuselage centerline. This wing parameter will directly influence the design of other aircraft components including aircraft tail design, landing gear design, and center of gravity.
- 3) Wing configuration (straight, tapered, delta etc): It is basically how the wing is shaped i.e. whether it is a tapered wing, a straight wing or a delta wing. It basically portrays the top view of the wing.
- 4) Span (b): wing span or just span is the length of the wing. The wingspan of an aircraft is always measured in a straight line, from wingtip to wingtip, independently of wing shape or sweep.
- 5) Wing area (SW or Sref or S): the projected area of the planform and is bounded by the leading and trailing edges and the wing tips.
- 6) Aspect ratio (AR): Aspect ratio (AR) is defined as the ratio between the wing span b and the wing Mean Aerodynamic Chord (MAC). The Aspect Ratio of a wing is defined to be the square of the span divided by the wing area and is given the symbol AR. For a rectangular wing, this reduces to the ratio of the span to the chord length as shown at the upper right of the figure.
$$AR = s^2 / A = s^2 / (s * c) = s / c$$
- 7) Taper ratio (TP): Taper ratio (TP) is defined as the ratio between the tip chord (C_t) and the root chord (C_r). This definition is applied to the wing, as well as the horizontal tail, and the vertical tail. $TP = C_t / C_r$
- 8) Tip chord (C_t): The chord length of the wing near the tip of the wing is called tip chord.
- 9) Root chord (C_r): The chord length of the wing near the fuselage is called root chord.
- 10) Mean Aerodynamic Chord (MAC or C): It is the straight line connecting from the leading edge and the trailing edge.
- 11) Airfoil: The cross-sectional shape obtained by the intersection of the wing with the perpendicular plane is called aerofoil
- 12) Twist angle (or washout) (TA): If the wing tip is at a lower incidence than the wing root, the wing is said to have negative twist or simply twist ($\square t$) or washout. On the other hand, if the wing tip is at a higher incidence than the wing root, the wing is said to have positive twist or wash-in. The twist is usually negative which means the wing tip angle of attack is lower than root angle of attack.
- 13) Incidence (IW) (or setting angle): The wing incidence (IW) is the angle between fuselage center line and the wing chord line at root. It is sometimes referred to as the wing setting angle (W_{set}). The fuselage center line lies in the plane of symmetry.
- 14) Aileron: Ailerons are roll-control control surfaces of the RC Airplanes. Ailerons provide roll by moving in opposite direction to each other. When one aileron moves down the other moves up thus providing more lift on one side as oppose to the other causing the RC Airplane to roll. Ailerons are at the trailing edge of RC Airplane wing and towards the wing tips.
- 15) Wing loading: wing loading is the loaded weight of the aircraft divided by the area of the wing. The faster an aircraft flies, the more lift is produced by each unit area of wing, so a smaller wing can carry the same weight in level flight, operating at a higher wing loading. Correspondingly, the landing and take-off speeds will be higher. The high wing loading also decreases maneuverability.

2) Tail design:

Tail configuration: It is basically the position of the tail in an aircraft. Ex:
Aft tail and one aft vertical tail, aft tail and twin aft vertical tail etc.

1. Horizontal tail

- 1) Planform area (Sh)
- 2) Tail arm (*T*)
- 3) Airfoil section
- 4) Aspect ratio (ARh)
- 5) Taper ratio (TR)
- 6) Tip chord (Ch_tip)
- 7) Root chord (Ch_root)
- 8) Mean Aerodynamic Chord (MACh or Ch)
- 9) Span (bh)
- 10) Sweep angle (SA)
- 11) Dihedral angle (DA)

2. Vertical tail

- 1) Planform area (Sv)
- 2) Tail arm (*T*)
- 3) Airfoil section
- 4) Aspect ratio (ARv)
- 5) Taper ratio (TR)
- 6) Tip chord (Ct_v)
- 7) Root chord (Cr_v)
- 8) Mean Aerodynamic Chord (MACv or Cv)
- 9) Span (bv)
- 10) Sweep angle (SA)
- 11) Dihedral angle (DA)

DESIGN CALCULATIONS

1) Design of wing:

In designing a wing, shown in figure 2, there is a systematic approach in order to determine various parameters step by step. To start the calculation the minimum data required is the gross weight of the aircraft and the wing span.

So, weight of the aircraft is 840gm, wing span is 914.4mm (36”) and aspect ratio is 5.5

SL NO.	AIRCRAFT TYPE	ASPECT RATIO
1	Hang glider	4-8
2	Glider (sailplane)	20-40
3	Homebuilt	4-7
4	General Aviation	5-9
5	Jet Trainer	4-8
6	Low subsonic transport	6-9
7	High subsonic transport	8-12
8	Supersonic fighter	2-4
9	Tactical missile	0.3-1
10	Hypersonic aircraft	1-3

Table 1: Aspect Ratios for Various Aircrafts.

The aspect ratio selected is 5.5 because ours is a homebuilt aircraft so according to the given table 1, we have chosen it to be in the correct range.

Step1: To determine the plan form area (S_{wing})

$$AR: b^2/S_{wing}$$

$$S_{wing}=b^2/AR$$

$$S_{wing}=914.4^2/5.5=1520.23 \text{ cm}^2$$

Step 2: wing loading selection: keeping in mind the structural constraints the wing loading must not exceed 0.6 gm/cm²

Wing loading= Mass of the aircraft/ S_{wing}
Wing loading=840/1520.23 =.55254gm/cm²

Step 3: Taper ratio (TR) = 1 (because we are using a straight wing).

Step 4: $C_{root}=2*S_{wing}/(b*(1+TR))$
 $= 2*1520.23/(91.44*2)$
 $=16.625cm$

Step 5: $C_{tip}: (TR * C_{root}) = (1*16.625) =16.625cm$

Step 6: To find the value of C_{root}' .

C_{root}' is the chord length at the random position of the wing.

Since the wing we are using is a straight wing the value of $C_{root}=C_{tip}$

Wkt $(C_{root}-C_{tip})/(b/2) = (C_{root}'-C_{tip})/((b/2)-4)$

Therefore $C_{root}'=C_{tip}=16.625cm$

Step 7: Determination of mean aerodynamic chord (C').

Mean aerodynamic chord is the width of the wing along the span where the entire lift is assumed to be acting.

$C'=2*C_{root}(1+TR+TR^2)/(3*(1+TR))$

$C'=2*16.625(1+1+1)/(3*(1+1))$

Therefore $C'=16.625cm$

Step 8: Determination of aerodynamic center(X)

Aerodynamic center is defined as the point along the width of the wing where the entire lift force is assumed to act.

$X=(C_{root}'-C') + C'/4 = (16.625-16.625)+16.625/4$

$X=0+4.15625$

Therefore $X=4.15625cm$

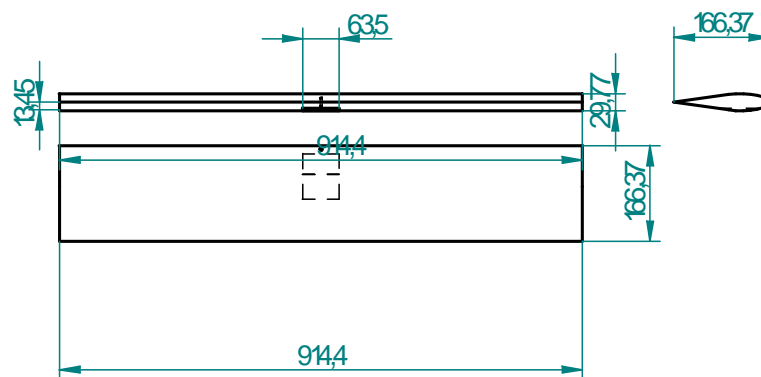


Fig 2: Front, top & side view of the wing.

Step 9: Airfoil Design: the co-efficient of lift is to be obtained and this is determined by equating the lift obtained from the wing to the aircraft weight.

$L=W$.

$0.5*\rho*V^2*C_L*S_{wing}=M*g$

Where ρ is the density of air = $1.225kg/m^3=1.225*10^{-3}g/cm^3$
 g is acceleration due to gravity = $9.81m/s^2=9.81*10^2cm/s^2$.

V is the cruise speed = $15m/s=15*10^2cm/s$

C_L obtained in this calculation is the 3D value.

$S_{wing}=1520.23cm^2$

$M=840g$

Therefore $C_{L3D}=0.3933$

The aircraft is generally trimmed at 3 to 5 degrees angle of attack (α). This range of values keeps the aircraft away from stall angle providing a safer flight.

Angle of attack, $\alpha=3$ (assumed)

So, finally the airfoil used is of a symmetrical airfoil.

Symmetrical airfoil used is “NACA 0018”

2) Horizontal stabilizer Design:

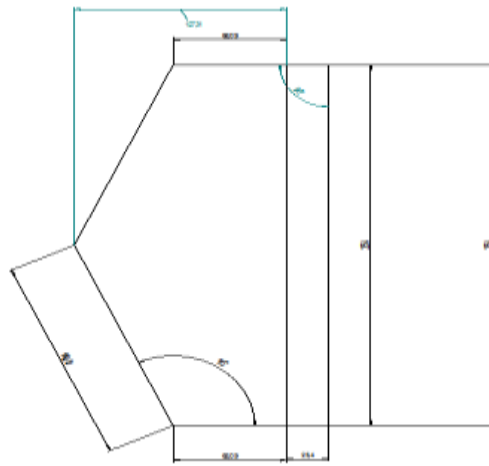


Fig 3: Top view of the tail (horizontal stabilizer).

Step 1: Choose the tail area (S_t) to be around 14-15% of the wing area. (For better stability of the aircraft)
 $S_t = 220 \text{ cm}^2$ (percentage $\times S_{wing}/100$)

Step 2: The aspect ratio of tail is chosen to be less than that of the wing so that the stall in tail is delayed with respect to that of the wing
Aspect ratio of tail (AR_t) should be between 3-5
Therefore we have chosen aspect ratio of the tail as 3.

Step 3: Tail span (b_t) = $(AR_t \times S_t)^{1/2}$
Therefore $b_t = (3 \times 220)^{1/2}$ [$AR_t = 3$ assumed]
Hence $b_t = 25.6904 \text{ cm}$

Step 4: Taper ratio of the tail (TR_t) = 0.66 [assumed]

Step 5: Tail root chord $C_{root t} = 2 \times S_t / (b_t (1 + TR_t))$
 $C_{root t} = 2 \times 220 / (25.6904 (1 + 0.66))$
 $C_{root t} = 10.3174 \text{ cm}$

Step 6: tail tip chord (C_{tip}) = $(TR_t \times C_{root t}) = (0.66 \times 10.3174)$
Hence $C_{tip} = 6.8094 \text{ cm}$

Step 7: Choose the tail setting angle (i_t) to be 1 degree-1.5 degree less than α (angle of attack).
 $i_t = 4 - 1 = 3$.

Step 8: elevator area is $2.54 \times 25.4 \text{ cm}^2$

3) Vertical stabilizer design (rudder):

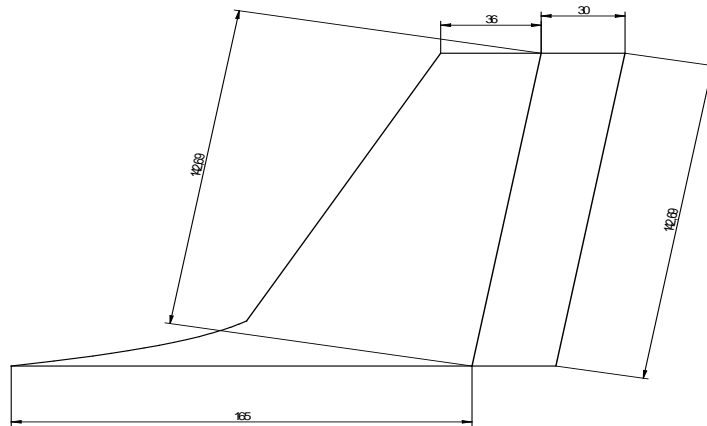


Fig 4: Right side view of the tail (vertical stabilizer).

Step 1: Fin area is the static part of the rudder.

Fin area= 30-35% of stab area

$$\text{Fin area} = 32.5 * 220 / 100 = 70.9 \text{cm}^2$$

Step 2: to calculate elevator area

Elevator area = 15-20% of stab area

$$= .16 * 220 = 35.45 \text{cm}^2$$

Using this area we can find the geometry.

4) Design of fuselage:

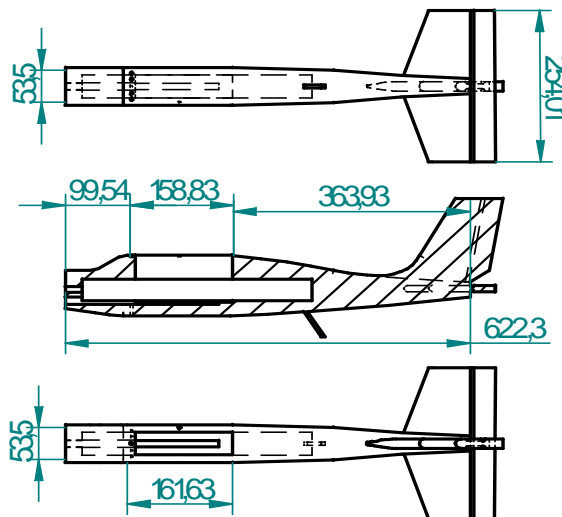


Fig 5: Three sectional views of the fuselage.

The fuselage is mainly designed based on empirical formulae that were developed by comparing various designs of many classic aircrafts like as cessna skylane, piper cub, fokkertrimoter airliner etc. to give an aerodynamic design i.e. a streamlined body.

The length of the fuselage was empirically taken as 75% of wing span

$$\text{Therefore } L_{\text{fuselage}} = 0.75 * \text{wing span} = 0.75 * 91.44 = 68.58 \text{cm}$$

The front cross sectional area is $6.35 \text{cm} * .35 \text{cm}$ and the end cross section is $1.27 \text{cm} * 1.27 \text{cm}$.

The maximum width is 10.16cm.

A stepped slot is made as shown in the above figure 4 in order to accommodate the various electronic components.

3-D CAD MODEL OF THE AIRCRAFT

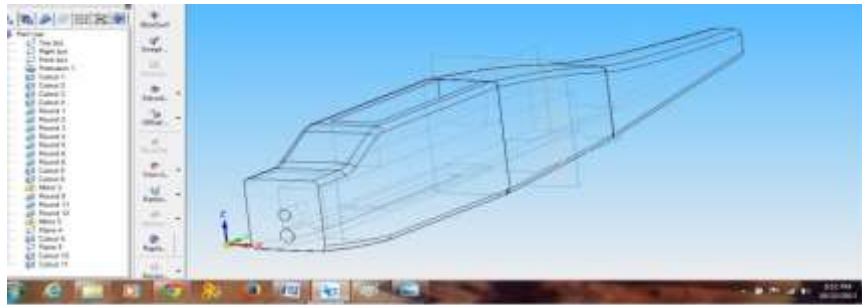


Fig 6: Wire Frame view of the fuselage.

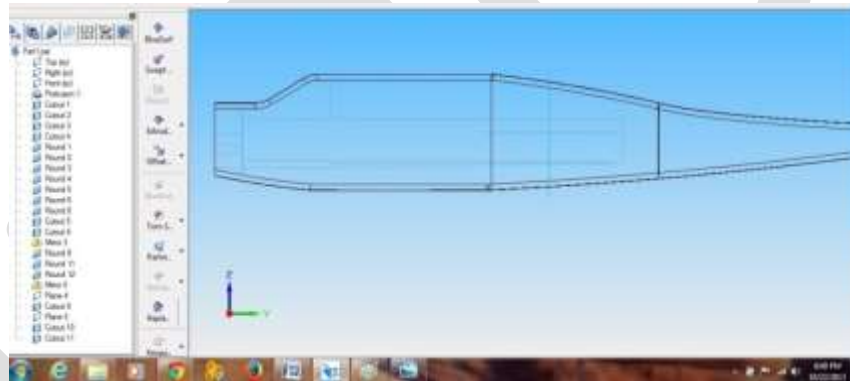


Fig 7: Right side wire frame view of the fuselage.



Fig 8: Front wire frame view of the fuselage.

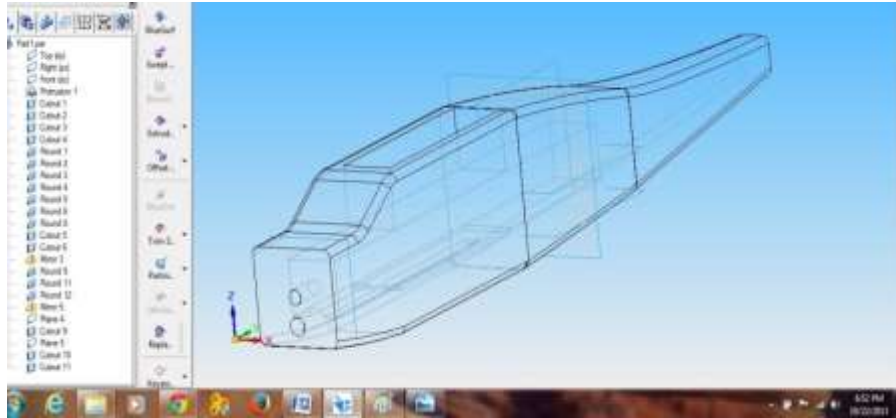


Fig 9: Isometric wire frame view of the fuselage.



Fig 10: 3-Dimensional Solid view of the Aircrafts wing.

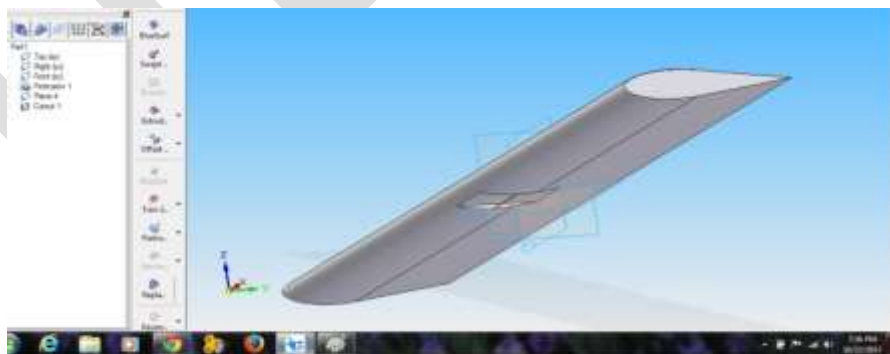


Fig 11: 3-D model of the wing with slots.

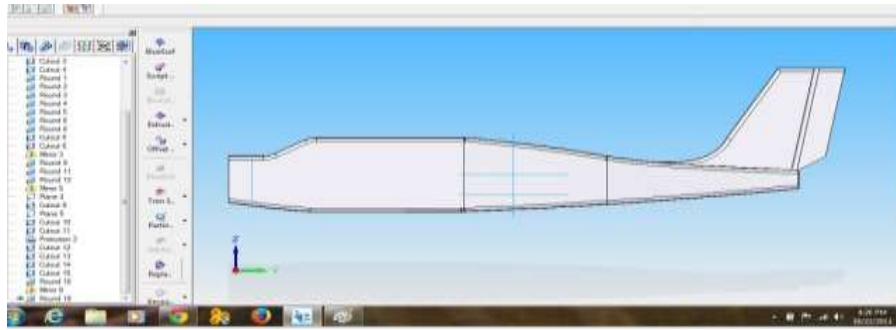


Fig 12: Right side solid view of the aircraft along with vertical tail.

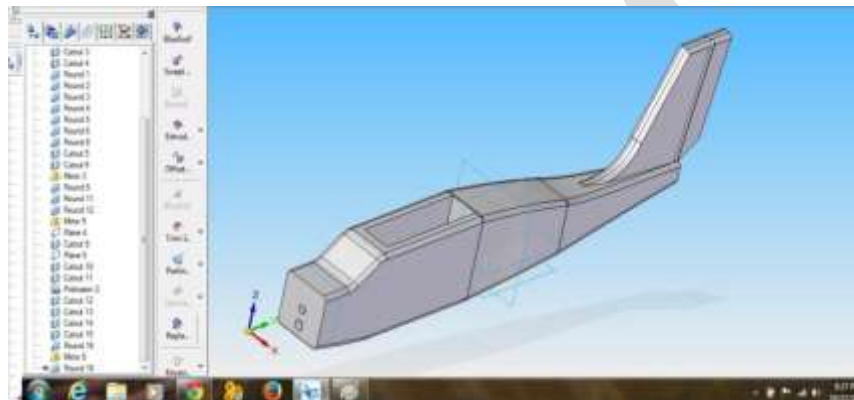


Fig 13: Isometric solid view of the aircraft along with vertical tail.

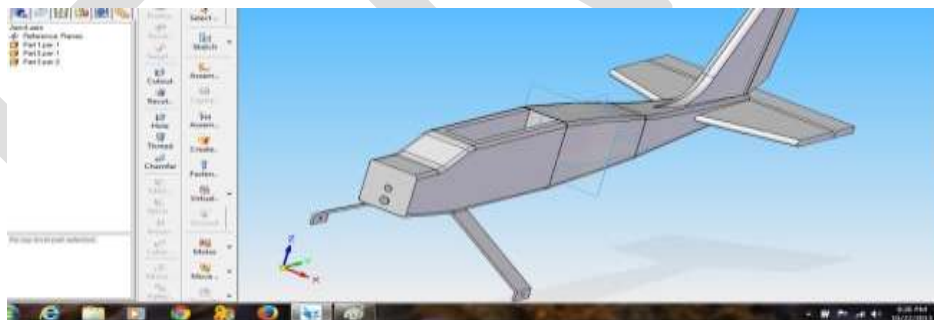


Fig 14: Isometric view of the aircraft along with Conventional Tail Configuration.



Fig 15: Final Completed view of our High Winger, Conventional tail aircraft in Solid Edge.

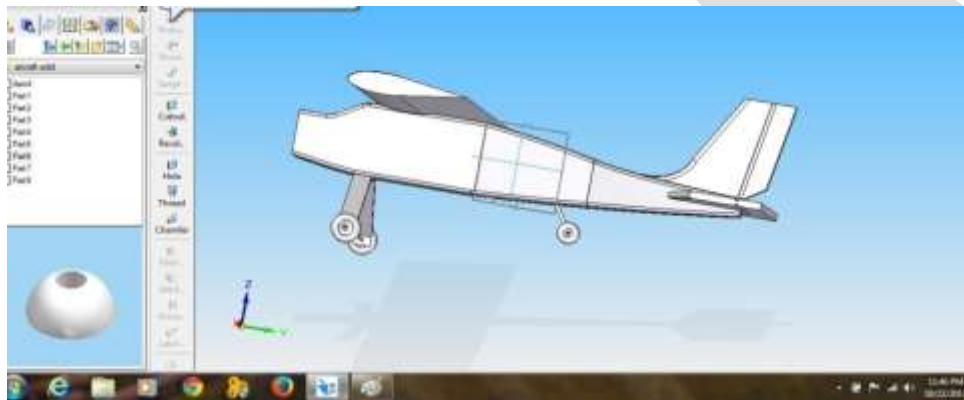


Fig 16: Completed view of our aircraft in Solid Edge.

ELECTRONIC COMPONENTS USED

Various electronic components are used in the working of the aircraft. There is a step by step procedure to select each and every electronic component. We select motor and propeller by considering the weight of the aircraft. The first component that we have to consider is

- 1) Brushless motor: The most popular type of motor being used for model airplanes today is the Brushless Out runner Motor. They provide a greater power-to-weight ratio, but cost a little bit more than the traditional brushed motors. Out runner motors produce a lower rpm, but produce more torque and can drive their propellers directly. This eliminates the weight and complexity of a gear box. The size of the motor is determined by the weight of your model airplane, which determines the size of the propeller. In essence, you need to choose a motor that will be able to generate the required rpm for the propeller. We have used 1100kv brushless electric motor. Brushless motor is as shown in figure 17.



Fig 17: Brushless DC Motor.

- 2) Propeller: Propellers for RC airplanes are nothing more than vertically mounted rotating wings. Their job is to convert the engine power in to thrust, to pull/push the plane through the air. Thrust is generated in exactly the same way as lift is generated by the wing, and that's why props have a profile airfoil section. Shown in figure 18.
We have used a 10x7E prop.



Fig 18: Propeller-10X7E.

- 3) Esc: The ESC is a device that regulates the amount of power that goes to the electric motor. The device may be separate from (but plugged into) or a part of the receiver. ESC stands for electronic speed controller. The ESC interprets signals from the receiver and works to provide variation in motor speed and direction and may act as a braking mechanism. There are electronic speed controls for brushed and brushless motors. We have used a (30amp esc) shown in figure 19.



Fig 19: Electronic Speed Controller.

- 4) Servo: A servo is a device for moving a part of the model. Shown in figure 20. Usually servos operate the rudder and elevator on a three channel model and the aileron as well on a four channel model. The throttle may be operated by a servo or on electric models it may be operated by a speed controller called an 'electronic speed controller' that plugs into the receiver and it connects the control rods.

We have used a 9g servo.



Fig 20: Servo.

- 5) Receiver: The receiver is one component which you really cannot choose. It comes along with the radio, and works only with that particular radio on a certain pre-defined frequency. It is connected directly to the "servos", and has a thin single wire antenna that extends outside the airplane. The receiver gets signals from the transmitter when you move a stick/control. These signals are then passed through to the servos, or ESC, which respond appropriately. We are using a 7ch receiver and transmitter. Receiver is shown in figure 21.



Fig 21: Receiver.

6) Batteries: We used 3 cells, 11.1v Lipo battery of 1800mah.

All the above consideration of the electronic components is done on the basis of the weight of the aircraft and the components are selected by selecting how much thrust is required and which configuration gives that much capacity. Shown in figure 22.



Fig 22: LIPO Battery.

7) 2.4 Ghz Radio Transmitter:

A transmitter or radio transmitter is an electronic device which, with the aid of an antenna, produces radio waves. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. Transmitter is shown in fig 23. When excited by this alternating current, the antenna radiates radio waves.



Fig 23: Transmitter.

8) Control Rods:

Control rods are used to transmit power from the servo to the control surfaces of the aircraft such as the ailerons and rudders. The control rod is shown in the Fig 24.



Fig 24: Control Rods.

9) Hinges and Clevis:

Hinges and clevis are the components that are used to fasten the control rod and control surface. The hinges and Clevis are shown in the Fig 25.



Fig 25: Hinges & Clevis.

SPECIFICATIONS OF ELECTRONIC COMPONENTS

PROP – 10x7E
To get 1600gms Thrust
Lipo – 3cell 11.1V
Operating Voltage – 10.8V
Amp draws at load – 32.7 amps
ESC - 30 amps
Power – 327W

SIMULATION OF THE CAD MODEL

After the completion of the design, 3D CAD model is generated using solid edge, as shown in the above figures 6-16 above, this model can be simulated using software called X-PLANE. The X-Plane software also has a 3D modeling software in which you can build your 3-D CAD model of your plane and fly it in a graphical user interface. This software will fly the plane in real time and it can be found out if any errors in the design and re-modify using some tools and redo simulation.

FABRICATION OF THE AIRCRAFT

The material used in fabricating was Styrofoam. Styrofoam shown in figure 26 is extruded polystyrene an insulating material. The purpose of using styro foam from a wide variety of materials such as balsa wood, thermocole, depron etc was because

- 1) It has a very fine grain size when compared to other materials such as high compressed thermocole
- 2) It can be mould into any desired shape.
- 3) It is very light weight.
- 4) It is very stiff
- 5) It is very cheap when compared to other materials available.



Fig 26: Styrofoam.

Because of all the above advantages styro foam was chosen.

During fabrication of fuselage, print out of the 2D draft of front view and top view of the fuselage was taken, stuck it on to the styro foam and the desired shape was cut using a “foam cutter”.

A device called foam cutter is built, where the guitar sting is connected between 2 parallel pipes. This string is connected to an external adapter which has an output capacity of 3.5amps. This high current causes the wire to get heated up. Now this heat is used to melt the foam. When tension is being applied in both the ends in opposite direction and moving it along a desired path the required shape of the fuselage and other parts can be obtained.

The same principle is adopted in manufacturing wing and tail of the aircraft. After cutting using the foam cutter the parts are sanded according to the required aerodynamic shape.

Then the tail is stuck onto the fuselage of the aircraft using hot glue. In order to give it good strength the fuselage and the wing is stuck by tissue paper and diluted Fevicol. Then the Fevicol is left to dry for 1 day. As a result the body and the wing would have become stiffer and had high strength.

Fabrication stages of our Aircraft:



Fig 27: Sticking the 2D draft of the fuselage on to the Styrofoam material.



Fig 28: Foam Cutter device manufactured in order to cut the Styrofoam material into desired shape.



Fig 29: Styrofoam material cut in layers so as to form the fuselage.



Fig 30: Top View of the Material after cutting.



Fig 31: Side view of the fuselage along with wing.



Fig 32: Slot provided on the top to accommodate electronic components.



Fig 33: View after cutting & sanding of the Styrofoam material.



Fig 34: Coating of the fuselage with dilute Fevicol along with Tissue paper.



Fig 35: Assembly of the Wing & Landing gears to the fuselage.



Fig 36: Assembly of motor and electronic components.



Fig 37: Final completed aircraft.



Fig 38: Completed Aircraft.



Fig 39: Completed High Winger Conventional tail Radio controlled Airplane.

BASIC ANALYSIS OF THE WING

Here in this section lift, drag, co-efficient of lift v/s angle of attack etc are found out using software called design foil. Virtual wind tunnel analysis is done on the airfoil which has been selected in the design process. This option allows you to vary the angle of attack and observe the varying nature of coefficient of lift (CL), coefficient of drag (CD), etc as shown in figures 40-45. Thus this analysis is basically conducted to mount the wing at the optimum angle of attack so that required amount of lift is generated.

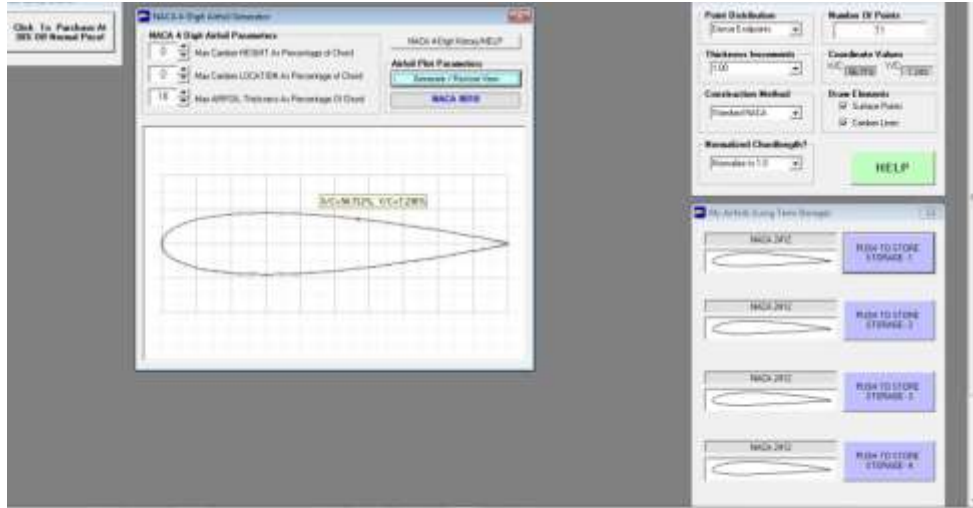


Fig 40: Wing Analysis of the aircraft for NACA 0018

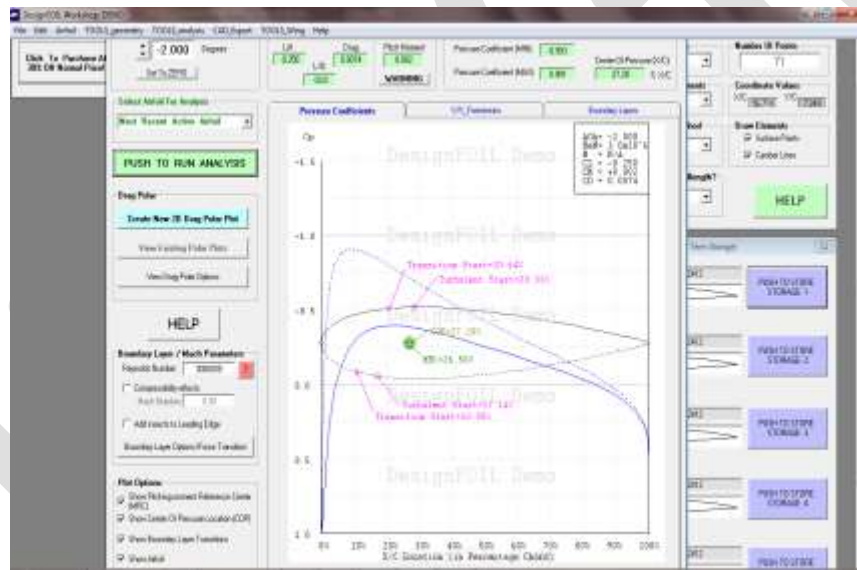


Fig 41: Wing Analysis of the aircraft for NACA 0018

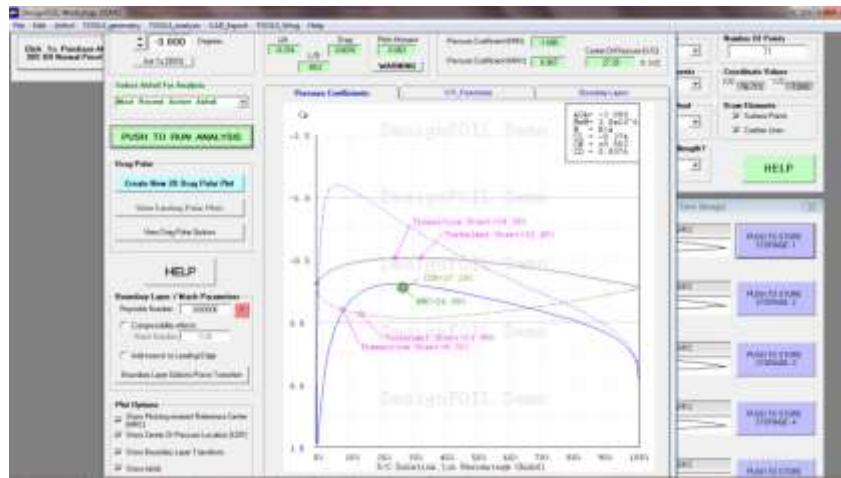


Fig 42: Wing Analysis –Different value of Lift vs. Drag (NACA airfoil 0018) for a particular angle of attack

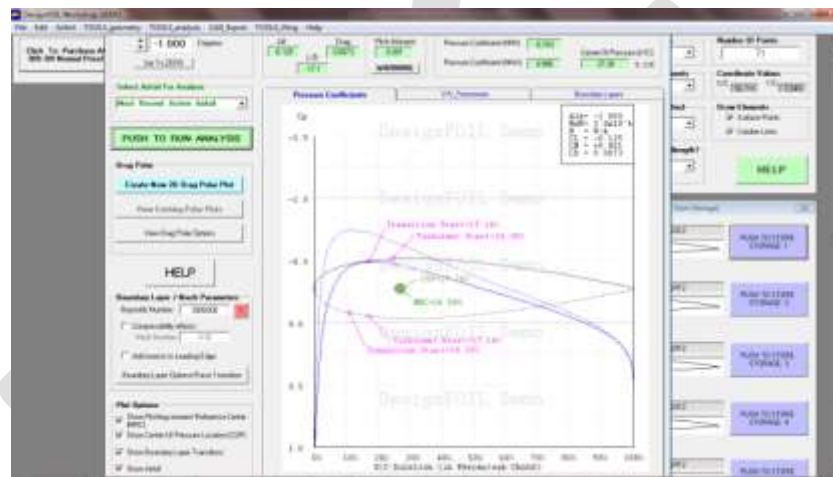


Fig 43: Wing Analysis –Different value of Lift vs. Drag (NACA airfoil 0018) for a particular angle of attack

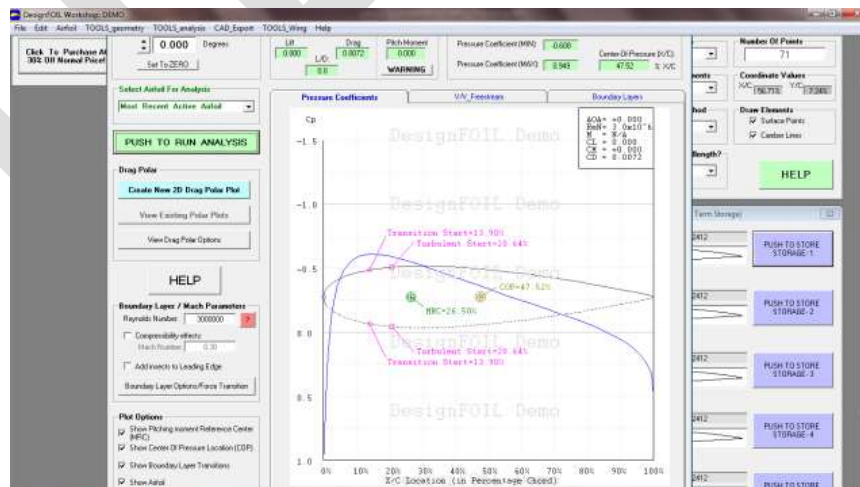


Fig 44: Wing Analysis –Different value of Lift vs. Drag (NACA airfoil 0018) for a particular angle of attack

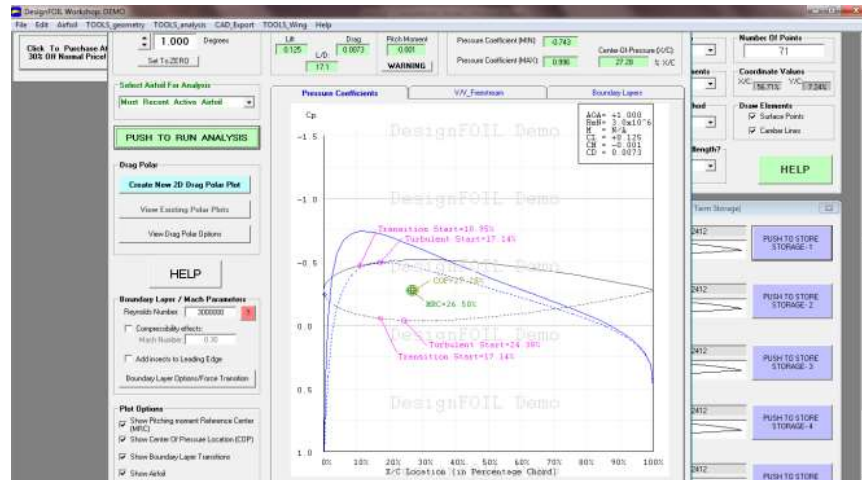


Fig 45: Wing Analysis –Different value of Lift vs. Drag (NACA airfoil 0018) for a particular angle of attack

Different value of lift and drag are calculated using “design foil” software. Thus at an angle of attack $\alpha=3$ degree the lift obtained from design foil is closely equal to the lift obtained from the calculation. Thus the aircraft was fabricated in these methods and was successfully flown.

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FUTURE SCOPE

In spite of the budget cuts that loom over the industry, the future of Radio controlled airplanes (RCA) is still looking bright. Future RCAs may be capable of reaching heights that are over double or triple what the A160 can reach and stay in the air for months at a time. These RCAs would resemble gliders with solar panels to maintain power and sensor arrays. Rather than rely on satellite imagery these RCAs would give war fighters persistent situational awareness.

Tiny RCAs that can be flown through open windows are in the works. These minuscule aircraft will stay airborne in times measured in seconds or minutes while giving valuable information to soldiers on the ground without giving away their position like a thrown ground vehicle might.

In addition to new technical capabilities, the future of RCAs is trending towards automated systems. Rather than having several personnel monitoring a RCA, in the future it is expected that one person can monitor many different RCAs at once. In the field of Defence, Automation frees up soldiers to perform other tasks and ultimately is a cost-saving measure, as fewer personnel are needed for RCA flights.

The future scope of our project related to RCA, lies in the field of CFD Analysis of the complete prototype, Mat lab programming, implementation of the innovative design to full scale, improvement of aircrafts weight, empennage configuration, fabrication methods and also wind tunnel testing. The RCAs aren't just the product of wishful thinking; they are the main source of technology in the near future especially in the field of defense.

CONCLUSION

- This project work deals with “Design, Fabrication & Analysis of a High Winger Conventional tail Radio controlled airplane”. The project has been successfully carried out and also the 2D & 3D drawings of the Front view, Top View and Side View are shown.
- 3D model is generated using SOLID EDGE V19 modelling software.
- Modifications can further be done on model to improve the design and quality.
- Analysis is done on Aircrafts wing using Design Foil software & the airfoil chosen is NACA-0018.
- Comparison is done between Theoretical calculations & values obtained in design foil software.
- As per analysis results, the value of lift obtained from the software is nearly equal to that of the calculated value.
- The Aircraft designed was flown successfully.

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