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DESIGN, ANALYSIS AND FABRICATION OF CANARD WING CONFIGURATION

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Abstract

In aeronautics, canard is an airframe configuration of fixed wing aircraft in which the forward surface is smaller than the rearward, the former being known as the "canard", the aim of this project is to design, analysis and fabricate of the canard wing configuration. The first step in our project we do design of the canard wing configuration and analysis the aerofoil we do take in the design and conduct the 2D flow analysis by putting the canard aerofoil followed by main wing aerofoil by means the flow pattern how seriously affect the main wing. Then we fabricate the canard configuration by placing the canard in the best place that does not affect the main wing flow parameter. A canard design tends to be less controllable than a conventional design because aileron on the main wing may be subject to turbulence from the canards that varies widely at different angle of attack leading to conditions of deep stall. If the ailerons were located on the canards, we used to find the best place where the canard aero foil suits well and it does affect the main wing flow parameter in the cruise speed at high angle attack. Canards have poor stealth characteristics because they present large, angular surfaces that tend to reflect radar signals

Keywords: Canard, Wing, Drag, Aircraft, Aerofoil, Angle Attack.

1. INTRODUCTION

In this configuration, the weight of the aircraft is shared between the main wing and the canard wing. It may be described as an extreme conventional configuration with the following features:

- A small, highly-loaded wing
- The c.g. significantly aft, at 500% chord
- A relatively large lifting tail to give enough stability with this extreme aft c.g.

For example, a lifting-canard generates an upload, in contrast to a conventional aft-tail which typically generates a downward lift force that must be counteracted by an sextra lift on the main wing, which may appear to unambiguously favor the canard. However, the downwash interaction between the two surfaces is unfavorable for the canard, and favorable for the conventional tail, so the difference in overall induced drag is actually not obvious, and depends on the details of the configuration.

Another example is that the upward canard lift appears to increase the overall lift capability of the configuration. However, pitch stability flight safety requirements dictate that the canard must stall before the main wing, so the main wing can never reach its maximum lift capability. Hence, the main wing must then be larger than on the conventional configuration, which increases its weight and profile drag. Again, the relative merit depends on the details of the configuration and cannot be generalized.

In any case, pitch stability requires that the lift slope of the canard wing is lower than the lift slope of the main wing to achieve stability, the change in lift coefficient with angle of attack should be less than that for the main plane. The first powered airplane to fly, the wright flyer, a lifting-canard, was pitch unstable. Following the first flight, the Wright Flyers had some ballast added to the nose.

The most common way in which pitch stability can be achieved is to increase the wing loading of the canard. This tends to increase the lift induced drag of the fore plane, which may be given a high aspect ratio in order to limit drag. A canard airfoil has commonly a greater airfoil camber than the wing.

With a lifting-canard, the main wing must be located further aft of the center of gravity than with a conventional aft tail, and this increases the nose-pitching moment caused by the deflection of trailing-edge flaps. Highly loaded canards do not have sufficient extra lift to balance this moment, so lifting-canard aircraft cannot readily be designed with powerful trailing-edge flaps.

1.2. Control Canard

In the later control-canard, most of the weight of the aircraft is carried by the main wing and the canard wing is used primarily for longitudinal control during maneuvering. Thus, a control-canard mostly operates only as a control surface and is usually at zero angle of attack carrying no aircraft weight in normal flight. Combat aircraft of a canard configuration typically have a control-canard. In combat aircraft, the canard is usually driven by a computerized flight control. One benefit obtained from a control-canard is avoidance of pitch up. An all-moving canard capable of a significant nose-down deflection will protect against a pitch-up. As a result, the aspect ratio and wing-sweep of the main wing can be optimized without having to guard against pitch-up.

2. DESIGN AND ANALYSIS

The Design, analysis of canard aerofoil and main wing aerofoil of the canard configuration conducted by using XFLR5 and CATIA V6 .

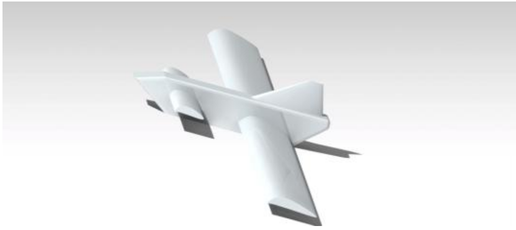

Figure: 1 *CATIA vs MODELLING Side view*

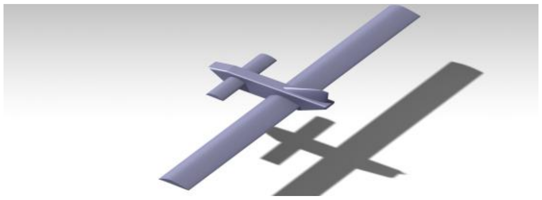

Figure: 2 *CATIA vs MODELLING Top view*

The analysis of canard aerofoil and main wing aerofoil of the canard configuration conducted by using XFLR5.

2.1 Canard Aerofoil Comparison

The comparison made between the E63,E64 which does not affect the flow pattern at high angle of attack. Then chose the aerofoil which does not affect the most at high speed and high angle.

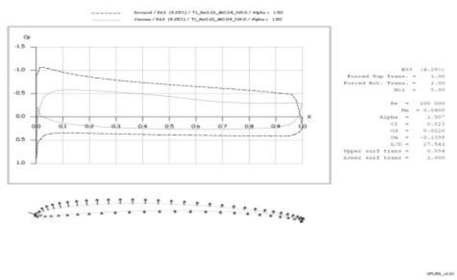

Figure: 3 Co-efficient pressure distribution all over E63

Figure 3 shows that Co-efficient pressure distribution all over E63 scanard aerofoil from this we can analysis the co-efficient of pressure over E63.

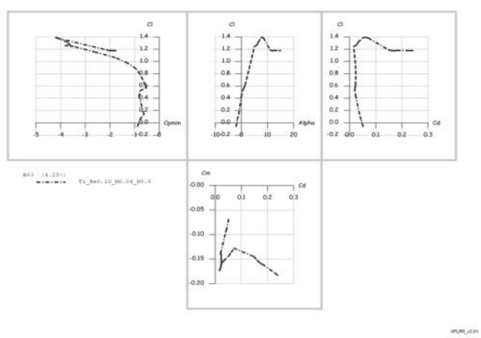

Figure: 4 Angle of attack of -2 deg to 15 deg

Angle of attack of -2 deg to 15 deg specifies the angle between the chord line of the wing of a fixed-wing aircraft and the vector representing the relative motion between the aircraft and the atmosphere. Since a wing can have a twist, a chord line of the whole wing may not be definable.

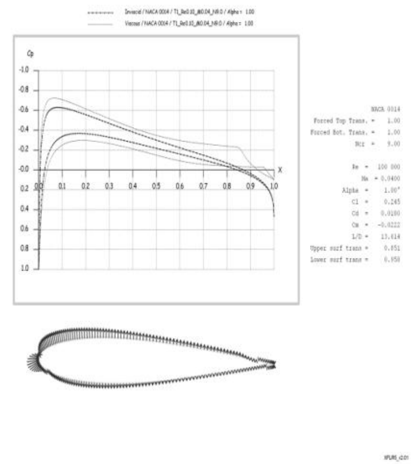

Figure: 5 Co-efficient of pressure distribution

Figure 5 shows that Co-efficient pressure distribution all over NACA 0014 Symmetrical canard aerofoil from this we can analysis the co-efficient of pressure overflow.

2.2 Canard

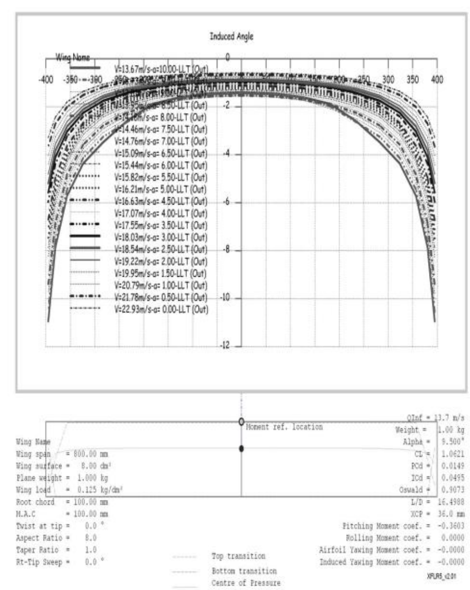

Figure: 6 Canard wing at the angle of attack between -2 to 15

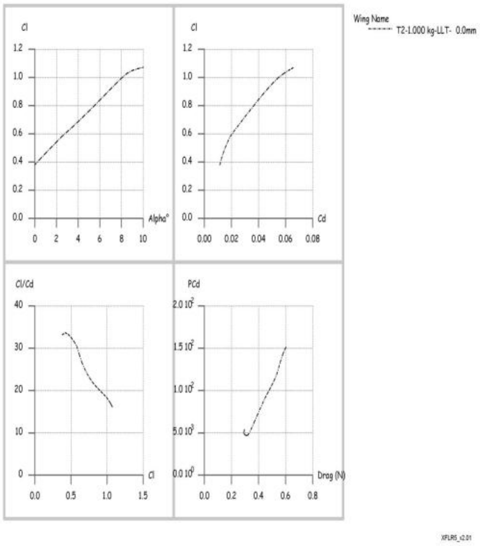

Figure: 7 Canard wing at the angle of attack between -2 to 15

The fig 6&7. Shows that canard wing at the angle of attack between -2 to 15 of induced angle in this curve.

2.3 Flow Analysis

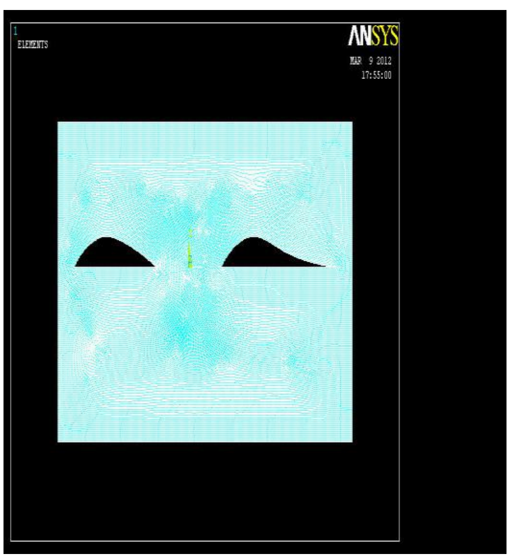

Figure: 8 meshing of edge element length of 0.02

The above figure 8 shows that the leading edge in meshing of edge element length of 0.02.

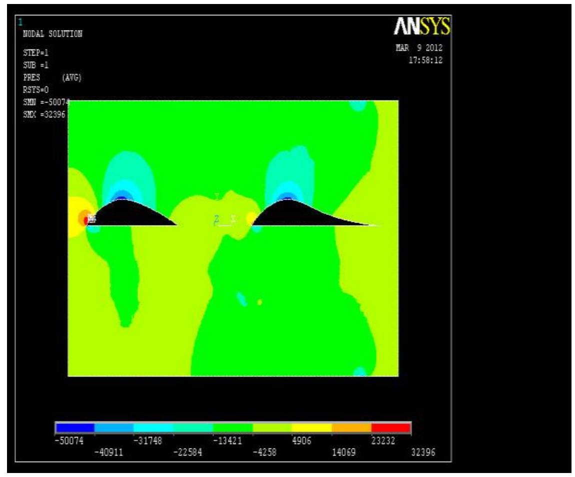

Figure: 9 Pressure distribution over the series of aerofoil

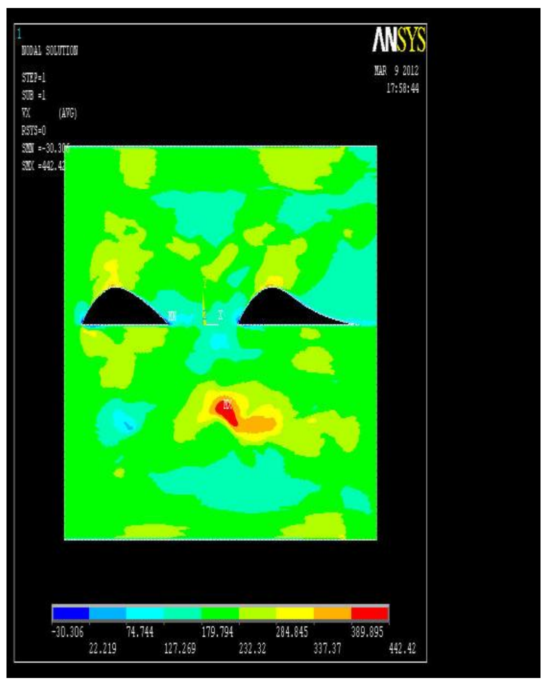

Figure: 10 X-component velocity variation on the aerofoil

The figure 9, 10, 11 shows that the flow, thermal analysis of Pressure distribution over the series of aerofoil, X and Y component velocity variation on the aerofoil.

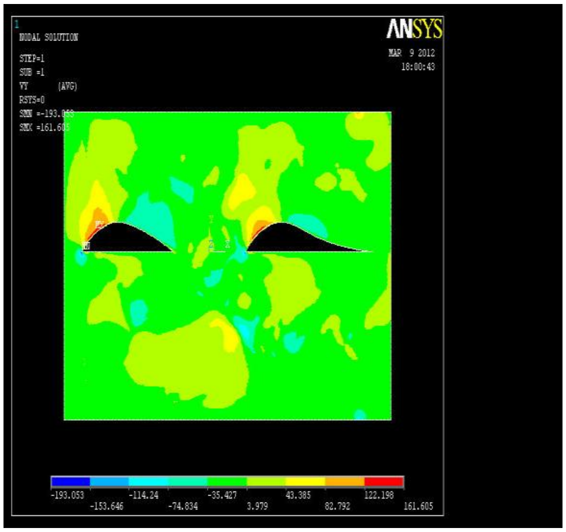

Figure: 11 Y-component velocity variation on the aerofoil

3. FABRICATION

In this, the Euppler 64 aerofoils were put into the laser cutting of the correct co-ordinates in the Balsa wood. In this the E64 aerofoil has the circular web in the middle.

Figure: 12 E64 Aerofoil

The main body is first made with thermocol and its covered with glass cloth, then it is pasted by the resin of about double layer, then it is made to dry for the whole day. The weight is estimated, then it thermocol is removed and the model is made of the high stiffened body and the accessories were fixed on it.

Figure: 13 Canard section

Figure: 14 Full canard

Figure: 15 Fuselage

Figure: 16 Main wing

The main wing is made of the NACA 2415 aerofoil which is laser cut to the required measurement. It is made of serious of palette and the resin is applied to the balsa aerofoil followed by styro foam sheet is placed over the aerofoil and applied pressure over in order to bond and finally made to dry. The vertical stabilizer in the main wing is placed and it is pasted with the plastic resin and made to dry for the whole day.

After the design and analysis of canard wing we fabricated prototype aircraft for the purpose as an application of passenger and military aircraft to increases cruising speed and analysis of main canard wing aerofoil configuration.

4. CONCLUSION

In our canard wing configuration, we used to find the best place where the canard aerofoil suits well and it does affect the main wing flow parameter in the cruise speed at high angle attack. By this canard wing can used for the passenger aircraft for the future development. The result shows a pronounceds effect of canard aspect ratios to the BWB aerodynamics, particularly on the pitching moment. The BWB is statically stable as the change of moment with respect to angles of attack.

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