HOVERING THROUGH NEW HORIZONS

Preliminary Report

ABSTRACT

Investigating the possibility of a transportation method which lifts by generating its own fluid flow against its own stationary aerofoils.

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Individual Project (ECM3101, ECM3102)

- Introduction:

Aerofoils have always been a major component in the advancement of the field of engineering. The aim of this project is to introduce a new concept based on a theory has been around for years. This theory explains that when an aerofoil moves through a fluid, it creates a difference in pressure, thus producing an aerodynamic force. A component of this force is perpendicular to the direction of motion, which is known as the “lift” force.

The concept behind this project is to reverse-engineer aerofoils and the way they behave. Commonly, an aerofoil is thrust through a fluid to obtain lift, but the opposite—thrusting a fluid along the aerofoil—may yield the same result. This is seen when test objects are secured to the ground in wind tunnels to counteract the force perpendicular to the fluid’s motion. The question posed here is: would it be possible to lift an object, which generates its own fluid flow, against its own stationary aerofoils in practice?

The project will be broken down into several steps. Initially, the internal and external design will be structured through 2D drawing, followed by 3D modelling using SolidWorks. Afterwards, the amount of lift required to raise a certain weight off of the ground will be calculated. The calculations will utilise proper wingspan, aerofoil shape, angle of attack, and fluid velocity, in addition to other factors. Afterwards, these values can be scaled up to test it in practical settings, its efficiency, and estimate cost and energy effectiveness.

This project aims to prove whether reverse-engineering aerofoils will result in flight or not. Beyond that, this concept can be taken further to provide an energy efficient mode of transportation. The model will utilise electrical generators to spin the propellers, which in turn, supply fluid (in this case, air) along the stationary aerofoils. This results in lift that produces zero carbon emissions. Additionally, solar panels will be used to charge the generator, further utilising renewable energy sources. At this point in time, the world needs to shift towards renewable energy. This model falls precisely into this domain, and will, hopefully, aid in that shift towards a greener future.

- Background and Literature Review:

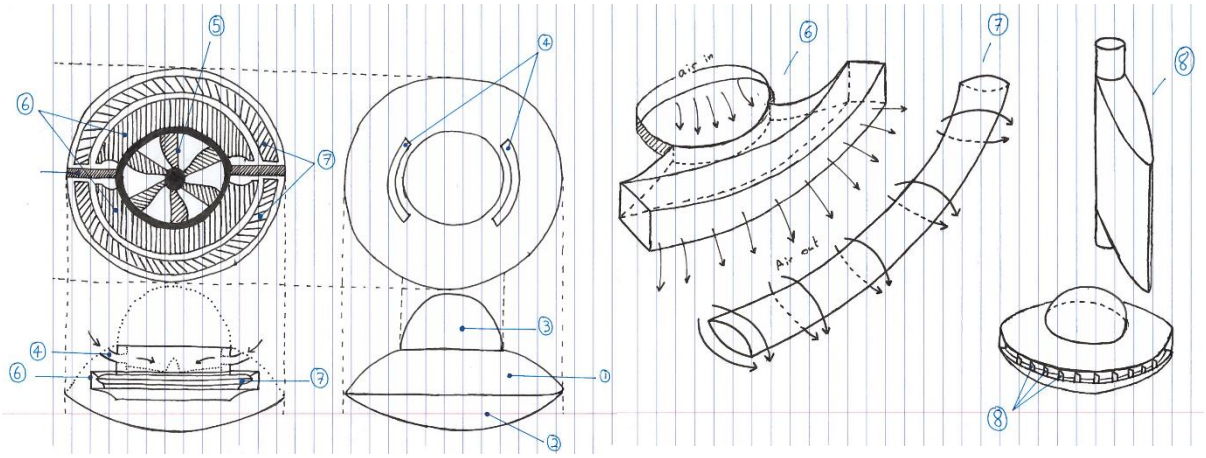
Aerodynamics was discovered by ‘Sir George Cayley’; and in 1799, Cayley discovered and identified the four aerodynamic forces of flight: weight, lift, drag and thrust ("George Cayley Founds Aerodynamics & Invents The Airplane (1809 – 1810) : Historyofinformation.Com"). Aerodynamics is the study of how fluids interact around a solid moving object. Since the fluid encountered the most is air, aerodynamics is primarily concerned with forces of drag and lift which are parallel and perpendicular to the fluid motion respectively. These component forces are caused by air passing over and around a solid body ("Aerodynamics - Introduction To The Science Of Air Flow").

In the world of aerodynamics, the question that puzzled the engineers was the ability of birds to fly; this puzzle explained by aerofoils. When an aerofoil moves through air, air is split and a portion moves above the wing and the rest moves below. The air passing above the wing gets spread out or expanded and hence the pressure decreases, while the air passing

below the wing moves straight enough to maintain its speed and pressure. To maintain equilibrium, higher pressure air tends to move to a lower pressure region, this applies to the air underneath the wing which is at high pressure considered to the region above, thus pushing the wing upwards to reduce its pressure. This process is known as the lift, and at higher speeds this value increases ("What Is Airfoil?"). Since drag is an important force component of the aerodynamic force, it increases and wind velocity increases, so the challenge is in designing a proper aerofoil profile to a better ratio between 'Lift' and 'Drag' forces.

- Preliminary Work:

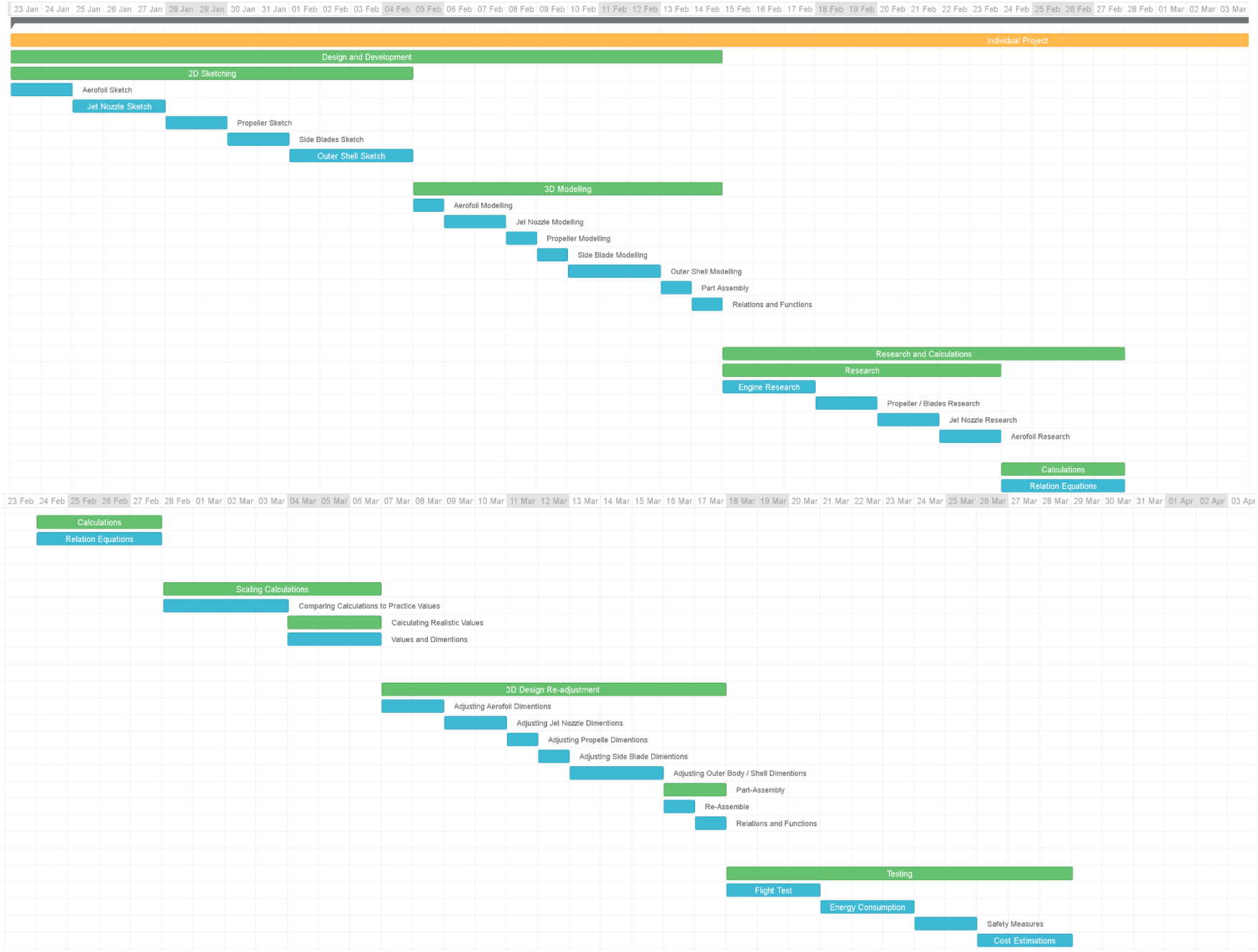
The drawings bellow are provided to show the concept design of how this concept will be applied:



1) Top half Body Part: Covers and shields the inner components.
2) Bottom half body part: It is a base that hold the inner components.
3) Wind shield: Shields the passenger from wind.
4) Air ducts: Provide wide air channel for the propellers to draw in air.
5) 2-fan blades / Propellers: Rotating against each other eliminating any angular velocity, intakes air at high pressure.
6) Wide air nozzles: Thrust air at high velocity along the aerofoils.
7) Aerofoils: Generate lift force.
8) Air blades: Direct excess air for manoeuvre.

The conceptual design drawn above shows the chief components, which provide a basic idea about the inner mechanism on how the scale model is going to lift its self-off of the ground. Further work will include 2D detailed sketch which will secure all design aspects, which will be followed by a 3D modelling to structure the model and bring it to life. Further analysis will be provided containing relationship calculations including total mass, fluid velocity, aerofoils, and wing span, in addition to other factors. The model will be re-designed accordingly to fit the proper criteria and test it for flight. If the project succeeds, this concept can be developed to be applied to other applications.

- Project Plan, Mythology:



- References

- "Aerodynamics - Introduction To The Science Of Air Flow". *Explain that Stuff*. N.p., 2016. Web. 8 Dec. 2016.

- "George Cayley Founds Aerodynamics & Invents The Airplane (1809 – 1810) : Historyofinformation.Com". *Historyofinformation.com*. N.p., 2016. Web. 8 Dec. 2016.

- "What Is Airfoil?". *Innovateus.net*. N.p., 2016. Web. 8 Dec. 2016.