



Analysis Of Jet Propulsion System To Increase Its Efficiency By Using Solar Panel On Their Wings – A Review

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Abstract

This paper presents a review on which the main objective is to use of solar energy inside cockpit. With ever increasing demand for aviation fuel to power our aeroplanes and its steep rising costs the time has come for us to find a more cost effective, efficient and eco-friendly way to power our aircrafts, thus solar powered aircrafts came into existence. The planes have photovoltaic cells on their wings which gather solar energy thereby recharging the batteries that powers its propellers. Generally domain Aircraft uses conventional fuel. These fuel having limited life, high cost and pollutant. Also nowadays price of petrol and other fuels are going to be higher, because of scarcity of those fuels. So there is great demand of use of non-

exhaustible unlimited source of energy like solar energy. Solar aircraft is one of the ways to utilize solar energy. Solar aircraft uses solar panel to collect the solar radiation for immediate use but it also store the remaining part for the night flight In future solar powered airplanes could be used for different types of aerial monitoring and unmanned flights. This pre-synopsis briefly shows history, application and use of solar aircraft. We are focusing on analysis of efficient solar aircraft. We also modify the handling and stability characteristics. The viscous drag on the wing can be too big, nullifying the reduction of the induced drag. Wings have to be carefully designed so that these and other problems can be overcome.

INTRODUCTION

Lift is the force that directly opposes the weight of an aircraft and holds the aircraft in the air. It is generated by every part of the aircraft, but most of the lift is generated by the wings. This force acts through the centre of pressure of the object and is directed perpendicular to the flow direction. The flow turning theory is used to demonstrate airflow about the airfoil generating lift. Due to the airfoil geometry, the viscosity of an airflow and the effect

the airflow passes over the upper surface, and creates a vertical velocity of airflow past the trailing edge. As the airfoil bends the airflow near the upper surface, it pulls on the air above it and causes an acceleration of that air down to the airfoil. The pulling of the air causes a low-pressure system to form over the airfoil, creating a force called lift. We use a simplified wind tunnel to measure the lift force and drag force of a certain wing at



different angle of attack, then calculate the lift coefficient and the drag coefficient which are summarized in a graph. We compare our results with other existing results. However, we still observed the same pattern of curve. For the plane we used in this experiment, the plane DC-3, its centre of mass is in front of the focus, as shown on the left figure beneath. In the wind condition, when the angle of attack increases, it is easy to see that the pitch down moment increases as well, and the plane is able to reverse into the previous state. Also, in relative to the centre of mass, the moment of the wing's lift force and that of the empennage's force cancel each other, so that the plane achieves a balance even in windy condition. Energy comes in different forms. Light is a form of energy Sunshine is free and never gets used up. Also, there is a lot of it. The dream of flight powered only by the sun's energy or sunlight has long motivated scientists and hobbyists. A solar aircraft is one which collects energy from the sun by means of photovoltaic solar cells. The energy may be used to drive electric motor to power the aircraft. Such airplanes store excess solar energy in batteries for night use. Also there are rapidly increasing traffic problems in world and in our country also, so it is required to go for such small solar aircrafts which can be used for transporting goods or materials between places at short distance.

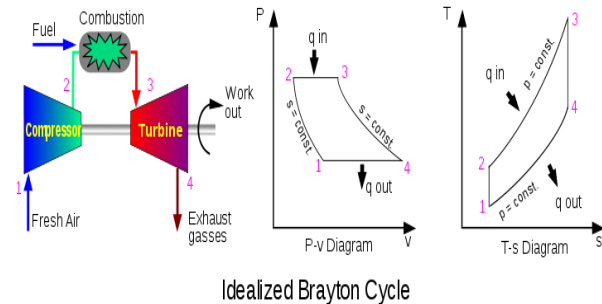


Fig 1: Basic equivalent diagram used for simulation



LITERATURE SURVEY

1. Nguyen Minh Triet on “Aerodynamic Analysis of Aircraft Wing”, Vietnam Journal on Aeronautical Engineering Vol. 31, No. 2 (2015)

This paper deal with Experimental or numerical simulation that can be used to analyze these computational models. This paper presents the modelling and simulating processes of computational fluid dynamic (CFD) problem on a aircraft wing model, using typical section as model of NACA 2412. This wing model might be chosen in the future experimental design. ANSYS is used to analyze the pressure and velocity distribution on the surface of wing. The lift and drag forces are also determined by ANSYS Structural.. The numerical results shown are compatible with those of the theory, thus suggesting a reliable alternative to predict the aerodynamic characteristics of the tested wing model in fabricating the Unmanned Aircraft Vehicles (UAVs). Aerodynamic problems in general are often difficult to solve by analytics analysis.

2. Alpesh Mehta, Shreekant Yadav, Kuldeep singh Solanki on “SOLAR AIRCRAFT: FUTURE NEED .” Vol.III Oct.-Dec(2015)

This paper intended to stimulate research on renewable energy sources for aviation. In future solar powered airplanes could be used for different types of aerial monitoring and unmanned flights. This review paper briefly shows history, application and use of solar aircraft. They are focusing on design

and fabrication of solar aircraft which is unmanned prototype. In this paper also described how effectively use the solar panel on wings so that Using solar panels there is more space due to escape of engines and turbines. Quite a few manned and unmanned solar aircraft have been developed and flown. The paper deals with the current state of art of empower the aviation industry with solar power and the shortcoming and the future aspect. The Autonomous Systems Lab of EPFL3 has developed with ESA program, an ultra-lightweight solar autonomous model airplane called Sky-Sailor. The main goal of this project is to research on navigation, control of the plane. The airplane will be capable of continuous flight over days and nights, which makes it suitable for a wide range of applications.

3. Andrew Klesh and Pierre Kabamba on “SOLAR-POWERED UNMANNED AERIAL VEHICLES:PERPETUAL ENDURANCE” sept -(2007)

This paper presents the effects of The problem of quantifying a design requirement for perpetual endurance of solar-powered unmanned aerial vehicles (UAVs) is treated. The design requirement is formulated as a threshold of the Power Ratio, a non-dimensional number that characterizes the ability of an aircraft to fly while solar-powered. This so called Perpetuity Threshold is identified, derived and shown to be related to the duration of daylight and length of the solar day. A lower bound on the Perpetuity Threshold is given and comparisons are made of this



threshold between Earth and Mars. To illustrate the difference of requirements for perpetual flight between these two planets, specific aircraft examples are characterized with respect to perpetual flight and discussed. The purpose of this paper is to identify this requirement and show its applicability to solar-powered aircraft design.

4. Shubham patil & Pratik thakur "SOLAR POWERED AIRCRAFT", March- (2016)

This paper discusses the sunlight that heats the Earth in an hour has more energy than the people of the world use in a year. A little device called a solar cell can make electricity right from sunlight. The dream of flight powered only by the sun's energy or sunlight has long motivated scientists and hobbyists. A solar aircraft is one which collects energy from the sun by means of photovoltaic solar cells. The energy may be used to drive electric motor to power the aircraft. Such airplanes store excess solar energy in batteries for night use This paper discuss over details when a fault occurs in TCSC transmission line, TCSC presents very complicated impedance characteristic and exerts influence on distance relay. In ground faults, the complex changes of sequence currents exert influences on mho characteristic, reactance characteristic and directional characteristic and make protection region unstable. Longitude distance protection with overreaching setting value may be a solution to TCSC line's protection, but it has difficulty in setting the relay on the

reverse directional line to avoid mis-operation.

5. Gaurav kumar & Shubham sapat on "Solar Powered UAV" feb -(2015)

In this paper the results of the application of multifunctional photovoltaic cell for the absorption of high wavelength radiation. batteries cannot solve these problems due to the weight restrictions; weight is inversely proportional to the flight time of the UAV. With the implementation of solar cells on UAV, the UAV would be able to collect and store solar energy by the sun to be used for the flight, and thus does not require returning to recharge (R/R) requirements. Again efficiency would play a major role; all the electronic sub-systems must be lightweight

PROBLEM DEFINITION

proposed propulsion system. The term jet engine loosely refers to an Internal Combustion Air Breathing Jet Engine (a duct engine). These typically consist of an engine with a rotary (rotating) air compressor powered by a turbine ("Brayton cycle"), with the left over power providing thrust via a propelling nozzle. Our mainly focused on improvement of turbojet .It is a reaction engine. A turbojet engine works by compressing air with an inlet and a compressor, mixing fuel with the compressed air, burning the mixture in the combustor, and then passing the hot, high pressure air through a turbine and a nozzle Substantial increases in thrust can be obtained by employing an afterburner Used in planes.



Fig 2: View of the integration of the solar modules on the wing

OBJECTIVE

The objective of this dissertation is to implement propulsion method to decrease the lift of aircraft and will analyses the parameters of solar wings . The objectives are: To decrease the lift of aircraft. Use of re-newable energy to save fossil fuels and reduce aviation. There is no key involved in the solar process. Only sequence counter are used. The main purpose of this research is to improve and avoid the attack by using the aviation fuels. In this scheme we are going to light weight, compact and eco-friendly model in to given types and we provide the minimum lift & improved safety .Employ active cooling. Designing better materials and alloys which retain their strength at high temperature. Smart structures – Structure and material which change their shapes and properties in flight.

DESCRIPTION OF THE PROPOSED WORK

How does the propulsion system work?

Beneath the wings of the solar impulse plane are four gondolas, each containing a 10 HP motor, a lithium polymer battery set and a management system controlling charge/discharge and temperature.

What is the solar impulse aircraft made of?

With a 63.40 m wingspan and with the necessary rigidity, lightness and flight controllability and just 1,600 kg take-off weight is a challenge that had never before been met in aeronautics. Solar Impulse is built round a carbon fibre-honeycomb composite using a sandwich structure. The upper wing surface is covered with a skin of encapsulated solar cells, and the undersides of the wings with a high resistance flexible film. 120 carbon fibre ribs placed at 50 cm intervals profile these two layers and give the body its aerodynamic shape Some of the challenges or hurdles faced by the solar impulse team were to ensure that the aircraft actually had enough power even during the night time to stay airborne moreover unlike other solar powered aircrafts this was much heavier as it was not a UAV and had a cockpit and pilot inside it so they had to actually make the plane as light as possible by removing all unwanted things in the aircraft. The aerodynamics of the plane had to be flawless and left no margin of error such that with minimum amount of power the plane could produce maximum speed also when faced with a turbulence the plane would remain stable and not increase its speed to extreme high levels unlike Helios which would cause the aircraft to disintegrate and crash. One of the biggest challenges which the solar impulse team is currently facing is that in order to make solar planes a reality such that it can be compared to any commercial plane of Boeing or Airbus, the solar impulse plane



must be able to carry a large number of passengers. Currently the solar impulse plane is able to carry only one pilot so the plane requires some significant modifications which will enable it to carry large number of passengers. Speed of the aircraft is also a very big problem while cruising around the world, since the speed of the solar impulse aircraft is less so it will be requiring a minimum of 20-25 days to fly around the world this means more food and drinking materials have to be loaded in the aircraft thereby further increasing the weight of the plane. So for this reason only the solar impulse team has decided to break the journey into five legs of two to three days each. While a tortoise-like pace saves energy, it introduces several problems. One is adverse yaw. When a plane banks into a turn, the aileron on the outside wing causes the wing to generate more lift than its counterpart on the inside wing. So now the solar impulse team has developed a special rudder which is modified specially for the solar impulse plane such that it can actually control the aircraft while turning even if the yaw effect is severe. The aircraft uses super-efficient solar cells and batteries to stay in the air after the Sun's rays had faded.. Currently the major constraint of the project is storing energy in the lithium polymer batteries.

METHODOLOGY OF WORK

For Analysis: CAD/CAM & ANSYS,
Finite Element Analysis Method.

CONCLUSION

The solar impulse aircraft is the aircraft of the future being dependent on solar energy and creating no pollution or harm to the environment it is definitely the technology or invention we are looking forward as it has the capacity to bring a revolution in the world of air travel by making it cheaper and more effective. The aircraft has four 10hp motors and 11628 solar cells which charge the batteries during the daytime, the plane also has a highly advanced onboard computer which helps it to conserve maximum amount of energy possible and its state of the art auto pilot system which helps the pilots a lot while flying during night time.

The solar impulse team was also facing certain problems or challenges even while building the aircraft they had to make the aircraft as light as possible thus for this reason they had to remove all unwanted weights but they had to also keep in mind that they should build the aircraft with such a material which was lightweight and yet strong enough to withstand a turbulence, so they finally built the aircraft completely with carbon fiber. Cruising at a speed of 70km/h is also a challenge for the solar impulse team as the slow pace of the aircraft will pose several problems for it when it goes for its journey around the world specially the aircraft might face the yaw problem. In spite of so many challenges and hurdles faced by the solar impulse team they have overcome most of them and that's why on the plane took off from Payerne, Switzerland at flew straight and landed on So we can say that the solar impulse aircraft is the aircraft of the future and soon in the years to come they will be



the planes which will fly in the sky carrying passengers around the world.

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