SOLAR ENDURANCE FLIGHT

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College ***:*** *Dayananda Sagar College of Engineering, Bengaluru*
Branch ***:*** *Department of Aeronautical Engineering*
Guide(s) ***:*** *Dr.Srikanth Salyan & Mr. Indranil Roy*
Student(S) ***:*** *Sayeeda Tayiba Fathima*
Khutejatul Kubra
Abdul Samad Ustad
Shah Dilawar Hussain

Keywords:

Lightweight, Cost-effective, Surveillance

Introduction:

Unmanned aerial vehicles (UAVs) have been the center of research works for several decades, now the emphasis has been shown on providing a medium for communication and surveillance through the use of high-altitude long endurance (HALE) UAVs. There are numerous aircrafts today that can uphold prolonged periods, however, an extensive and sustainable flight time is always something to pursue. In the recent years, a lot of research works have been centered on the solar power and its potential as an alternative power source. Depending on the application, the plane should be capable of a consistent uninterrupted flight. Thus focusing on more sustainable forms of energy energy generation such as solar power becomes more imperative. Taking into account a proper design and varying climate and thermal conditions, a solar powered aircraft could potentially fly for an excessive amounts of time.

A major constraint to the work around when designing an airborne vehicle is flow separation, which induces high energy losses and is excessively detrimental to a system that does not have the luxury to expend more power than necessary. Boundary layer separation, in the elementary terms, occurs when a high-speed flow separates due to an adverse pressure gradient when the flow is expanded due to a trailing edged surface, in this case, an airfoil.

Solar energy is the power from the sun. It is a vast, inexhaustible, and clean resource. We can use this energy directly to heat and light homes and businesses. Similarly, we can also produce electricity, and heat water, solar cooling, and a variety of other commercial and industrial uses.

Objectives:

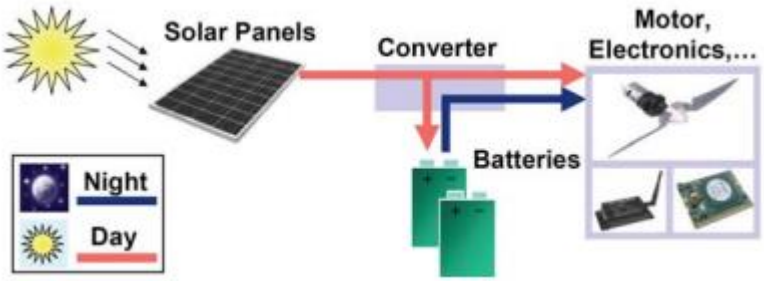
The objectives for the research work can be defined as follows:

- To understand flight characteristics of a solar plane.

- Design an aerodynamically efficient UAV structure to minimize drag and optimize energy consumption.
- Explore and employ cutting-edge lightweight materials to ensure structural integrity while minimizing overall weight.
- Selection of light material i.e balsawood for High altitude flight.
- Fabrication and testing of the aircraft in required conditions.

Methodology:

- We first begin with understanding the flight principle of a solar powered aircraft. This process allows us to learn and understand the parameters, which go into a solar powered aircraft design. Tools required would be CAD software etc.
- We then size the solar powered aircraft using historically available data. A solid model of the same would be developed which would help analyze the aerodynamic performance of the model.
- The Important parameters which govern the flight characteristics of a solar powered aircraft are: wing span, angle of attack, the horizontal and vertical stabilizer, Dihedral angle and length of fuselage are considered through a literature paper's specifications.
- The next objective would be to design and build an aircraft model with sufficient structural integrity, and modular enough to vary the above-mentioned parameters.
- Flight tests would be conducted to verify the results and performance obtained from theoretical calculations and simulations. The optimum configuration based on the above-mentioned parameters for a solar powered aircraft would be found for a particular weight category thereby concluding the project. Figure shows the solar energy conversion.



Conclusion:

The Solar Endurance Flight Project represents a pioneering endeavor at the intersection of renewable energy, aerospace engineering, and information technology. The project aims to address critical challenges in unmanned aerial vehicle (UAV) technology by harnessing solar power for sustained and eco-friendly flight. The integration of advanced solar panel technologies, lightweight materials, and aerodynamic design principles underscores the commitment to maximizing

energy efficiency. Overcoming challenges related to adverse weather conditions, regulatory compliance, and payload flexibility has required a holistic approach. The modular design of the UAV, coupled with the ability to operate in varying weather conditions, positions the project as a versatile solution applicable across diverse industries. In conclusion, the Solar Endurance Flight Project represents a bold leap towards a future where solar-powered UAVs contribute to sustainable and enduring aerial missions, offering transformative solutions for industries ranging from environmental monitoring.

Scope for future work:

1. Environmental Monitoring: Solar endurance flights can be utilized for environmental monitoring, including tracking weather patterns, monitoring pollution levels, and assessing changes in vegetation and land use over time.
2. Communications and Connectivity: Solar-powered aircraft can serve as communication relays in remote or disaster-stricken areas, providing connectivity for disaster response teams, remote communities, and emergency services.
3. Agricultural Monitoring: Solar drones equipped with sensors can monitor crop health, soil moisture levels, and pest infestations, allowing farmers to make informed decisions and optimize agricultural practices.
4. Humanitarian Aid: Solar-powered drones can be deployed for delivering medical supplies, food, and other essential aid to areas affected by natural disasters or conflict zones, where conventional transportation may be limited or unavailable.
5. Commercial Applications: Solar-powered drones could find applications in various industries, including agriculture, energy, telecommunications, and logistics, offering cost-effective and environmentally friendly solutions for aerial services.
6. Technological Advancements: Continued research and development in solar aircraft technology may lead to improvements in efficiency, endurance, and payload capacity, enabling new applications and expanding the capabilities of solar-powered flight.